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U.S. Information Services Market Analysis Program

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Industry Sector Markets 1992-1997

Discrete Manufacturing Sector

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INDUSTRY SECTOR MARKETS 1992-1997

DISCRETE MANUFACTURING SECTOR

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Industry Sector Markets, 1992-1997
Discrete Manufacturing Sector

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I

Introduction

A
Purpose

The basic objectives of this U. S. Information Services Market Analysis Program industry or vertical market report are to:

- Provide an introduction to the discrete manufacturing industry's structure, demographics and key submarkets that are influenced most by the use of information systems
- Identify business issues and trends that are driving the use of information services within the discrete manufacturing industry and key submarkets, and discuss the rapid changes in the use of information technology that information services vendors are now helping to bring about in this industry
- Discuss the use of information systems within the discrete manufacturing industry and key submarkets, particularly in regard to the impact of significant business issues such as continuing low sales rates, restructuring, and the impact of technological trends, particularly client/server use and downsizing
- Discuss the information services market within the discrete manufacturing industry and key submarkets, including market sizing and the factors driving market demand for each delivery mode within the market as a whole
- Discuss the competitive environment and profile leading information services vendors within the discrete manufacturing industry, noting differences among vendors as to strategies, products and submarkets they concentrate on
- Discuss the information services market within the discrete manufacturing industry and key submarkets, including market sizing and the factors driving market demand for each delivery mode within the market as a whole.

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B
Methodology

The data on which this report is based was gathered during 1991 and 1992 as part of INPUT's ongoing market analysis program. Trends, market size, and growth rates are based primarily upon in-depth interviews with users within the discrete manufacturing industry.

- INPUT maintains ongoing relationships within the discrete manufacturing industry and the IS vendors serving the discrete manufacturing industry.

- INPUT also maintains ongoing relationships with, and a data base of, all users and vendors that it interviews. Interviewees for the research portion of this report were selected from this data base of contacts.

In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include several on-line periodical data bases, subscriptions to over 50 computer and general business periodicals, continually updated files on over 3,000 information services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that vendors may be unwilling to provide detailed breakouts by delivery mode or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different delivery modes from those used by INPUT. Thus, INPUT must estimate revenues by these categories on a best-effort basis. The delivery mode and individual segment forecasts should be viewed as indicators of general patterns and trends rather than as specific, detailed estimates for individual years.

When the information is provided from vendors as requested, at times it is provided under an agreement of confidentiality. Therefore, vendor rankings based on these revenue figures should be considered indicative rather than definitive, and the revenues themselves should be viewed as approximations only.

1. Introduction

The manufacturing industry is generally divided into two primary sectors—discrete and process.

- The most significant difference is that discrete products are manufactured one at a time, even if the process involves a rapidly moving assembly line.

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- Process manufacturing products are made as the result of a process. Processes can be either continuous or batch and involve delivery in containers or cans like soup or in large storage containers like oil.

A model of the manufacturing industry is shown in Exhibit I-1. This model separates process and discrete manufacturing into two segments based on the difference in product output.

- There can be similarities between some large-scale repetitive, discrete manufacturing and process manufacturing concerned with products that are delivered in containers or cans.

- While other models may attempt to incorporate similarities as well as differences, this model captures the main distinction between discrete and process types of manufacturing processes.

EXHIBIT I-1

Manufacturing Industry Model

Process	Discrete
Continuous in batches or lots	One or multiple individual units Repetitive, flexible to job shop, custom project

In order to provide more insight into the differences between discrete products (manufactured singly) and process products (based on a continuous or batch process), five characteristics of manufacturing environments are compared in Exhibit I-2.

Key differences that are emphasized by this analysis include:

- Manufacturing methods
- Number and location of plants
- Costs of raw materials
- Computing environments

Although MRP and MRPII computing environments have been a characteristic of many discrete manufacturers, integrated environments including business, engineering and shop floor functions are growing in use.

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EXHIBIT I-2

Comparison of Discrete and Process Manufacturing

Characteristic	Discrete	Process
Typical Mfg. Methods	Assembly line	Batch/lot
Plant Structure	Small number of large plants, geographically concentrated	Large number of small plants, as well as some large plants, geographically dispersed
Costs of Raw Materials	Relatively fixed	Variable
MRP/MRPII Computing Environment	Batch-/transaction-oriented	Real-time- /transaction-oriented
Other Factors		• Material substitutions • Formula adjustments • Real-time process monitoring

2. Discrete Manufacturing Description

As shown in Exhibit I-3, the discrete manufacturing industry in the U.S. roughly covers the Standard Industrial Classification (SIC) code numbers 265 through 396, excluding 281 through 291, which refer to process manufacturing industries like food processing, plastic manufacturing and petroleum refining.

Although it is difficult to make many generalizations about the growth rates and usage of IS by all types of discrete manufacturing products, data published by the U.S. Census Bureau or gathered by INPUT may be used to characterize some segments of the discrete manufacturing market further.

- For instance, it appears that the automotive and electronics/instruments submarkets use manufacturing software products in over 50% of establishments.

- A much lower percentage of the companies in the consumer durables industries use such software products.

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U.S. discrete manufacturing industry segments vary by their growth rates, as well. This is due to the effects of the current recession and differences between industries.

- During the last few years, fewer than 10% of the U.S. discrete manufacturing industries grew by more than 5%, according to the U.S. Department of Commerce.
- Segments of discrete manufacturing that have grown faster in the recent past include laboratory and medical instruments, printed circuit boards and toys.

EXHIBIT I-3

SIC Groups in Discrete Manufacturing

SIC Group	Description
23xx	Apparel and other finished products
25xx	Furniture and fixtures
27xx	Printing, publishing and allied industries
31xx	Leather and leather products
34xx	Fabricated metal products except machinery and transportation equipment
36xx	Electronic and other electrical equipment and components except computer equipment
35xx	Industrial and commercial machinery and computer equipment
37xx	Transportation equipment
38xx	Instruments; photo, medical, optical goods, watches and clocks
39xx	Miscellaneous manufacturing including toys, games, jewelry and sporting goods

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3. Discrete Manufacturing Applications

INPUT's manufacturing model has groups or islands of automation, each of which includes three or four primary applications, as shown in Exhibit I-4.

EXHIBIT I-4

Applications in Discrete Manufacturing

(1) Business operations and planning
- General accounting
- Financial reporting
- Planning
  - MRP and MRPII
  - Scheduling
- Marketing/sales
- Material warehousing and handling
- Purchasing
- Human resources

(2) Engineering and design
- CAD/CAM
- Documentation
- Plant simulation
- Design engineering

(3) Factory floor
- Machine control
- Area control
- Plant monitoring

(4) Other applications
- Plant maintenance
- EDI
- CIM

- In this illustration, the traditional center of activity for IS personnel in manufacturing companies in this scheme is business operations and planning.

- In fact, research has shown that IS departments are often preoccupied with running, maintaining and enhancing large systems that might be

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obsolete for general accounting, financial reporting, and planning, and are reluctant, or at times simply incapable, of becoming heavily involved in the other islands of automation within the company.

New technological trends, particularly the use of client/server technology and downsizing, have been changing this situation and have spread even to factory floor operations, where attempts by IS departments to participate in CIM have often been thwarted due mainly to a lack of expertise in these operations.

4. Computer-Integrated Manufacturing

Of increasing importance to companies involved in discrete manufacturing is computer-integrated manufacturing, which really constitutes an approach to both information services and manufacturing within a company.

- Numerous models of discrete as well as process factory environments have been developed, some of them quite complex.

- These models represent a trade-off between the level of detail and the ease of understanding of the factory's operation.

As illustrated in Exhibit I-5, INPUT's model uses three groupings or islands of automation:

- Business applications
- Design/engineering applications
- Factory floor applications

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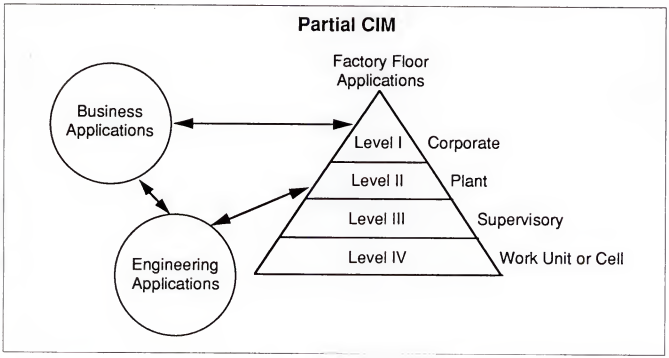
EXHIBIT I-5



In the past few years, vendors' sales literature has emphasized complete CIM solutions for the discrete manufacturing sector.

- To some of these vendors, CIM is the link between (a) any two of the three islands of automation or (b) any two of the four levels within factory floor environments depicted in Exhibit I-6.

- A true computer-integrated manufacturing environment will utilize a common data base that is shared by users in business, factory floor, and engineering applications. All three application groups are integrated, as shown in Exhibit I-6.

The growth of redundant files in different islands as well as the same island has made the goal of establishing a single relational data base capability and achieving direct connections between functions so important that these steps are being addressed before CIM or as steps toward CIM at a number of discrete manufacturers.

- The growing number of interconnections and plans to implement CIM have raised questions of standards and the use of open systems, which is also of importance in manufacturing currently.

- IS organizations have become a point of planning for the use of CIM as well as a point of coordination and information for users implementing interconnections through client/server and other technology. Because of this role, many IS organizations have also become the proponents of standards and the use of open systems.

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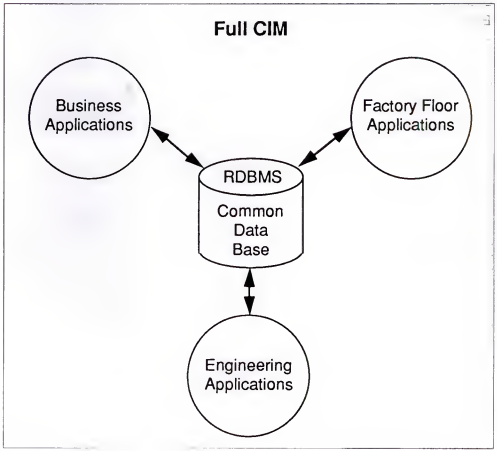
EXHIBIT I-6



5. Characteristics of the U.S. Discrete Manufacturing Industry

Exhibit I-7 describes some of the largest U.S. discrete manufacturing industries.

- Six of these industries could be classified as highly concentrated with relatively few firms participating, while the others are characterized by a large number of competitors.
- There are 16 other discrete manufacturing industries with 1990 shipments of over $10 billion, and 102 with less than $10 billion.

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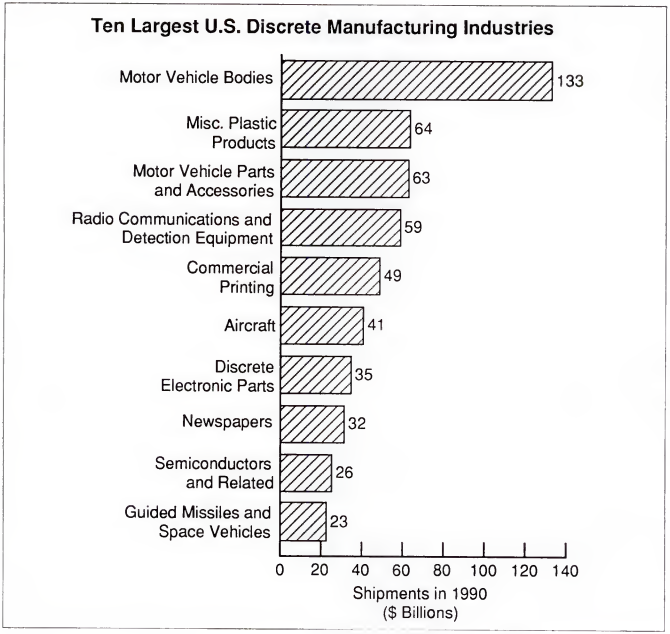
EXHIBIT I-7



Since it is difficult to analyze all segments of the discrete manufacturing industry, comments regarding factors of importance in the study will often be directed toward the groupings of submarkets that are shown in Exhibit I-8.

- The automotive submarket is often referred to in relation to discrete manufacturing because it is the largest submarket and has a high level of automation.

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- Other submarkets have needs or areas of opportunity for increasing use of information technology, including aerospace, where defense cuts are limiting some initiatives.

EXHIBIT I-8

Discrete Manufacturing Submarkets

Submarket Group	Selected Characteristics
• Automotive (includes trucks, buses, trains)	Largest submarket Level of automation Large projects
• Aerospace (includes missiles)	Impact of defense downturn Level of automation
• Electronics (includes radio communications and detection)	Challenges of computer and semiconductor segments Less mature IS environments
• Medical/Instruments (includes all dental, medical and laboratory equipment)	Above-average growth rate Selected areas of opportunity
• Machinery/Metal (includes metal products)	Need for improved automation
• Other (remaining discrete segments)	Good performance in some segments Selected opportunities

C
Organization and Contents of Report

In addition to this chapter, there are five chapters and two appendixes, which are described below:

- Chapter II—Trends, Events, and Issues—provides background information on the business issues and trends driving the use of information services within the discrete manufacturing industry. Forces of a general nature, such as the impact of the U.S. and world economies, and discrete

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manufacturing industry-specific forces, such as changes in the modes of delivery of IS and the rate of adoption of automation products and services, are discussed. The section on issues discusses the likely impact of the change in the structure of key segments of the industry.

- Chapter III—Information Systems Environment—provides an overview of the basic business processes in the discrete manufacturing industry, and their supporting information systems applications. The impact of the current economic environment and current budgeting issues in information systems within the discrete manufacturing industry are also discussed.

- Chapter IV—Information Services Market—discusses the discrete manufacturing market in detail, and is divided into the following sections:

  - Overview
  - Environmental Factors
  - Expenditures by Delivery Mode
  - Expenditures by Island of Automation
  - Vendor Analysis

- Chapter V—Competitive Environment—identifies leading IS vendors in the industry, discusses some of the factors that affect the competitive dynamics of the industry, and profiles representative vendors.

- Chapter VI—Conclusions and Recommendations—reviews the trends and opportunities described in the report and provides recommendations for vendors as well as users.

In addition, there are two appendixes:

- Appendix A presents industry-specific definitions used throughout the report.

- Appendix B presents the forecast data base and the forecast reconciliation. The forecast data base covers the 1991-1997 period and includes forecasts of user expenditures by delivery mode for the discrete manufacturing industry as a whole. The forecast reconciliation compares this report's forecast with the forecast provided in INPUT's previous discrete manufacturing report and explains the reasons for variations.

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II

Trends, Events, and Issues

A
Overview

Business trends, events, and issues that are currently having an impact on the discrete manufacturing industry are reviewed in this chapter.

- In succeeding chapters, the effect of these factors will be discussed in relation to internal information systems and activities and the use of information systems vendors.

- In general, these factors are encouraging discrete manufacturers to review means of improving sales through better service and product quality as well as means of reducing costs or achieving objectives with lower expenditures through reductions in operations and restructuring or the use, for example, of downsizing and new application technology, in information systems.

B
Issues

IS users in discrete manufacturing report that the promise held out by the information systems function throughout the 1980s of increased productivity has only been partially realized, and other objectives including service, streamlining of ordering and communication between workplace functions have become almost as important, if not more important, than productivity to some companies.

- A number of companies, particularly larger ones, have made significant investments in new robotics or automated design and engineering technology and some have seen significant productivity paybacks.

- Fewer firms have been able to capitalize on CIM, EDI, and JIT technologies, which could hold similar promise but have not been implemented on a large scale. Strategic planning of a broad enough scope to

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take advantage of technologies and services that have become available in the last few years does not exist in many U.S. discrete manufacturers.

Current business conditions and the economic climate make it difficult for manufacturers to concentrate only on steps that can improve their manufacturing capability and productivity. According to many users of information systems, the continuing recession in the U.S. and foreign competition are depressing sales in many of the submarkets in discrete manufacturing, as shown in Exhibit II-1.

- The effect of low sales and foreign competition is particularly strong on the automotive and machinery/metal products submarkets and segments of the other submarket category mentioned in Chapter I, including apparel and appliances.

- Factory orders showed no real improvement throughout 1991 and are expected to continue at levels that will keep industry depressed in most of 1992.

- At the end of 1991, the index of purchasing activity of the National Association of Purchasing Managers stood at a level that did not indicate that a recovery was likely in the near future.

Low sales can stimulate activities to recover market share or invade new markets, but IS users report that poor sales have more of a negative than a positive impact on their operations, as indicated in Exhibit II-1. The pressure to reduce costs resulting from the continuing depressed sales has been stronger than the drive for improvements.

- IS users also report that issues of restructuring, reductions in defense expenditures, and mergers and acquisitions are having impacts on their activities that are more negative than positive.

- The negative impacts that are mentioned are reductions in cost achieved through personnel cutbacks or the elimination or reduction of functions that could weaken the ability to sell or provide service.

However, a number of users report that there are issues in their companies concerned with improvement in service and product quality, and integration or interconnection of manufacturing functions and work units.

- These issues are having a positive impact on their activities, according to IS users, enabling them to obtain resources and initiate steps that can improve earnings.

- Some users are also responding to issues that generally have a negative impact on funding, such as the recession or restructuring, by asking for funds to improve performance in sales or other functions.

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EXHIBIT II-1

Issues Impacting IS Users

Issue	Magnitude of Impact	Effect on Spending Plans
Recession Impact on Sales	4.4	Negative
Restructuring or Cost Reductions	4.2	More Negative than Positive
Foreign and Domestic Competition	4.0	Mixed
Improvement of Service and Quality	3.9	Positive
Integration of Manufacturing Functions	3.9	Positive
Defense Reductions	2.9	Negative
Mergers/Consolidations	2.8	More Negative than Positive

Rating: 5 = high, 1 = low.

The issues listed in Exhibit II-1 that can impact IS users have a stronger impact in some manufacturing submarkets than in others, as shown in Exhibit II-2.

- Most of these issues have more impact on the automotive submarket than on others, as shown by the number of high-ranking issues in this submarket. It is a market area where new technology is being introduced to integrate functions and connect work units as well as to improve service and products. There are also significant factors that inhibit expenditures in this market such as continuing depressed sales and foreign competition.

- The electronic submarket and portions of the "other" submarket including apparel manufacturing also have a number of issues that are ranked at higher levels of impact.

- Of interest, one of the issues that has a relatively high positive impact across submarkets is integration or interconnection of functions and units. This is one of the chief reasons why client/server technology is expanding rapidly in manufacturing.

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EXHIBIT II-2

Issues in Relation to Submarkets

Issue	Automotive	Aerospace	Electronic Products	Medical/ Instrument	Mfg. and Other
Recession Impact on Sales	5.0	4.2	4.1	3.2	4.5
Restructuring or Cost Reductions	4.7	4.5	4.2	3.5	3.8
Foreign and Domestic Competition	4.8	3.5	4.4	3.2	3.6
Improvement of Service and Quality	4.3	3.0	4.3	4.2	3.6
Integration of Manufacturing Functions	4.5	4.1	4.1	3.0	3.7
Defense Reductions	2.5	4.9	3.7	2.0	2.3
Mergers/ Consolidations	3.0	3.0	3.0	2.5	2.4

Rating: 5 = high, 1 = low.

C
Trends

IS users feel that some of the issues just discussed as well as several other factors should really be viewed as business trends that are having an important and ongoing effect on their activities, as illustrated in Exhibit II-3.

- The improvement of productivity might be thought of as an objective more than a trend, but many respondents report that there are ongoing efforts to improve sales and reduce or control costs, which should be seen as a trend to improve productivity.

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- Users also report that they feel the integration and interconnection of functions are trends that must be dealt with. Since these activities are increasing, companies must develop plans and standards to accommodate them.

- Some IS users also noted that the integration of automated activities on the factory floor or between the factory floor and business functions or the implementation of CIM should be thought of as a major business objective since it is closely associated with productivity and the ability to react to customer needs.

The above comments demonstrate the existence of a strong link between business and the use of IS in discrete manufacturing. In the 1990s, this business commitment will be a precondition for improved use of information technology.

Among the trends identified by IS users, integration and interconnection were emphasized most in regard to the automotive, aerospace and electronics submarkets, but all submarkets ranked it as important.

EXHIBIT II-3

Trends of Importance Identified by IS Users

Trend	Relative Importance to IS Users
Improving Productivity	4.6
More Interconnection	4.4
Integration	3.9
Use of EDI	3.7
Structured Service	3.5
Innovation in Products	3.3

Rating: 5 = high, 1 = low.

As Exhibit II-3 indicates, providing service in a structured form through the use of voice mail or the use of a software product that prompts and monitors contact or other means is another trend reported by users. Introducing or achieving more innovation in products and using EDI more frequently are also trends that users identify from a business perspective.

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EDI was mentioned in regard to automotive and electronic submarkets most, and the service and innovation trends were mentioned at about the same level of importance in all submarkets.

D
Key Events

A list of key events was assembled in Exhibit II-4 to illustrate business- and information technology-related activities that are indicative of present conditions as well as new directions, interests and concerns in the discrete manufacturing industry.

- The national concern about foreign competition to the automotive and segments of the electronics and other industries has been marked by the president's visit to Japan as well as by political debates.
- Large cutbacks in personnel at auto manufacturers have emphasized the need to improve productivity.

EXHIBIT II-4

Selected Key Events/Situations

- National concern about foreign competition
- Cutbacks in personnel
- Use of information technology to increase productivity
- Growth of network use to improve operations
- Growth of integration strategies
- Use of outsourcing to reduce costs
- Partnerships between major education institutions and leading manufacturers

New approaches to key industry applications and integrated manufacturing have been taken in the last year.

- A number of organizations including GE, Intel and Motorola have taken initial steps to move much of their computing work to client/server technology to improve productivity, service or quality in operations.

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- Downsizing has also been used to increase productivity and/or reduce costs. Deere & Co. speeded up its mainframe MRPII processing through the use of downsizing and client/server technology. A vendor software product was used to achieve that goal.

- Major new networking applications have been installed at manufacturers such as Whirlpool and Caterpillar. Whirlpool has installed a WAN with imaging capabilities and an expert system that can help service agents gain information from product and service manuals so that they can diagnose and solve customer problems more quickly.

- Caterpillar continues to improve its advanced telecommunications satellite capability with the goal of allowing engineers to work simultaneously on the same image of a product from different locations.

- More integration of application systems is taking place in manufacturing. A new approach to CIM that can link manufacturing activities through a parallel processor has been installed at GM. This computing capability not only reduces the number of interconnections that are needed, but handles the processing required in a factory with a significant reduction in cost.

Outsourcing has proved to be of interest in discrete manufacturing, as noted in Exhibit II-4. A major user of computing known for its quality programs for IS, General Dynamics, announced that it would outsource computing to CSC.

Since there is a feeling that better trained college graduates are needed to make real improvements in manufacturing processes, one set of interesting events that has taken place, as noted in Exhibit II-4, has been the organization of special training programs at major universities such as MIT, Penn State, Northwestern, Cornell and Purdue.

- These programs produce trainees that have both engineering and business administration skills and who have the advantage of targeted internships in many cases.

- Major corporations that have helped to finance these programs have reported success from them.

Universities are also involved in other steps to aid manufacturing, such as the effort to evolve a strategic plan for U.S. industry that was carried out at Lehigh in 1991.

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III

Information Systems Environment

A
Driving Forces

Although the financial environment does not appear to favor increases in budgets in discrete manufacturing, there are driving forces in business that currently are having an impact on IS budgets, as shown in Exhibit III-1.

- These forces were reported by IS managers and users and ranked in relation to all discrete submarkets.
- The submarkets that respondents felt were most impacted are also indicated in Exhibit III-1.

The highest ranking drivers are concerned with improving service, facilitating sales and decreasing costs, according to respondents.

- Although quality is an overriding consideration and ranks very high, it is not the leading force.
- Some industry experts feel that considerations of quality should be integrated with other goals when planning responses.

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EXHIBIT III-1

Current Driving Forces
IS Budgets

Driving Force	Relative Importance to Respondents	Submarkets Emphasized by Respondents
Aiding Sales	4.9	All
Improving Service	4.7	Automotive Electronic
Decreasing Cost	4.2	Automotive Aerospace
Improving Quality	3.9	Automotive Electronic
Providing More Internal/External Connections	3.9	Automotive Electronic
Empowering Users	3.8	All
Adding to Product Revenues	3.6	Medical/Instrument Other

Rating: 5 = high, 1 = low.

According to IS managers and users, the highest ranking forces are helping to fuel the growth of technology that can interconnect sales and customer service functions and even customer locations to supply information about problems, product availability, specifications and features. The specific information technology considerations that these respondents noted in relation to driving forces on IS are shown in Exhibit III-2.

- The use of LANs and client/servers and expanded data management (relational data base capabilities as well as the means to handle data from existing applications) were mentioned in relation to both sales and service.

- The technology mentioned above can be of importance in relation to the driving forces concerned with quality by interconnecting design, manufacturing, quality control, customer service and other functions so that

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they can interact during the manufacturing process rather than at the end. A number of other steps can be taken in relation to quality, of course.

EXHIBIT III-2

Relation of Driving Forces to Information Technologies

Driving Forces	Information Technology
Aiding Sales	• LAN and client/server • Expanded data management
Improving Service	• LAN and client/server • Expanded data management • Downsizing
Decreasing Cost	• Downsizing, outsourcing, vendor products • Integrating functions • Upgraded applications • Connections for EDI or JIT
Improving Quality	• LAN and client/server • Upgraded applications • Integration
Empowering Users	• LAN and client/server • Downsizing
Adding to Product Revenues	• LAN and client/server • Upgraded applications • Outsourcing
Providing More Interconnections	• Networks • LAN and WAN • Integrated applications • CIM

The driving force concerned with empowering users can be served by client/server technology and downsizing. Access to central data and the distribution of functions can enable users to play a greater role in planning, integrating and even segmenting the use of information systems to achieve manufacturing goals.

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The drive to reduce costs can have a number of impacts on IS budgets because it has a number of information technology implications.

- It has resulted in plans and actions to reduce central IS capabilities, downsize application systems, implement EDI and JIT systems, interconnect functions so as to reduce redundant files and activities, and use tested vendor software products instead of in-house development.

- It is encouraging the outsourcing of IS functions such as systems operations, application management, development and maintenance to vendors.

- It has also resulted in demands for more technical expertise to implement, for example, the networks and central relational data management capabilities that can reduce redundant files and activities.

Technical expertise is particularly necessary to support the drive to provide more internal and external connections between related functions including those of suppliers who might be supplying parts and material on a JIT basis or customers who are accessing information on products or using EDI to order and pay for purchases.

- The need for expertise is extremely broad—it must address communications carriers and facilities, network equipment, communication software products, existing conventions and standards, the application systems being interfaced and the services of many types of vendors.

- Need for network technology also raises interest in expenditures for open systems products.

As shown, the driving forces that have been discussed in relation to budgets have strong implications in terms of the use of technology, particularly client/server technology, network capabilities and downsizing.

B
Information Systems Spending

The slowdown that began in discrete manufacturing in the third or fourth quarter of 1990 is continuing, and has had an impact on planning for 1992 information systems budgets, although there are pressures to increase these budgets as discussed in the previous section.

- As a consequence, there is a wide range of budget changes planned for information systems in 1992 versus 1991 among companies interviewed for this study, ranging from an 18% increase to a 10% decrease in budget.

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- The average change being planned is reported to be an increase of about 3%.

- This increase could easily be modified, depending on changes in business conditions caused by the budget pressures. User budgets would also be a source of funds in a number of instances, according to IS managers and users.

- The average change is held down by the relatively smaller percentage increases being planned by some firms in the automotive and aerospace submarkets. On a percentage basis, increases being planned in information systems budgets are larger in medical/instruments and other submarkets (see the submarket categories in Chapter I).

There are also pressures for changes in spending from established 1992 budgets being made by executive or user management that is interested in having IS expenditures made in support of departmental objectives rather than for general purposes, as shown in Exhibit III-3.

- These users are particularly interested in promoting the use of client/server and LAN technology, downsizing and/or integration.

- Increased budgets are also being sought for user software purchases and aid in customizing software products or using network capabilities.

- As noted before, there is a strong link between business planning and ideas for the future use of IT technology.

IS users are also interested in holding down areas of the IS budget that are not directly supportive of departmental plans, as shown in Exhibit III-3.

- There are pressures reported to reduce mainframe and data center budgets.

- There is also pressure, as shown in Exhibit III-3, to reduce or delay spending for long-term IS projects.

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EXHIBIT III-3

User Attitudes Toward Planned IS Spending for 1992

Desired Changes Reported by Users

- Reduction in central mainframe/data center spending
- Increase in user equipment spending
- Increase in spending for interconnectivity and networks
- Increases in spending for applications software product purchases by departments
- Increases in spending for aid with networks and customization of software products
- Reduction or delay of spending for long-term IS projects

Users are apprehensive about large, centrally controlled projects, but they do support changes in major systems in which they can be involved in restructuring or shaping to meet their needs.

Some IS managers and users felt that budget changes and pressures for further changes reflected shifts that were taking place in their budgets over a period of time.

- An increasing shift or increase in expenditures has been taking place recently to restructure and even to downsize functions of major manufacturing systems, including MRPII and factory floor systems in order to support more flexible manufacturing.
- A shift or increasing growth of expenditures for network applications, including client/servers, is felt to be taking place to support sales and service functions.
- Items such as CAD/CAM that are of importance are not generating a high shift in the use of information systems budgets since the present level of investment is already significant and budgets for them are often in user areas.

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- A shift of decreasing expenditures is taking place for centralized capabilities in some companies to improve productivity and reduce central IS costs.

The pressures and shifts in expenditures emphasize several major issues that IS reports it is facing, as illustrated in Exhibit III-4.

- A high-ranking issue is the lack of an overall plan for interconnecting and integrating automated functions in manufacturing facilities in many discrete manufacturers.

- There is also a lack of overall application strategies. Some discrete manufacturers have interfaced supplementary systems to existing MRPII systems to speed up their operation, or have started to test radically different approaches to MRPII without developing a plan for follow-up activities.

EXHIBIT III-4

Major IS Issues

Issue	Relative Importance
Lack of Sufficient Interconnection/Integration Planning	4.6
Overall IS Application Development/Upgrade Strategy	4.2
Ability to Reduce IS Costs	4.0
Role of IS	3.5

Rating: 5 = high, 1 = low.

An IS issue at a number of companies is how to reduce IS costs.

- Additional expenditures may have to be made to maintain existing systems, while efforts are also made to downsize functions from them or to upgrade or replace them to save costs.

- There are driving forces encouraging the use of more technology that can only add to IS expenditures.

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One result of this is that IS managers as well as users at a number of large discrete manufacturers are investigating outsourcing steps that might utilize a vendor's experience and capabilities to achieve objectives in a manner that reduces IS expenditures.

- Outsourcing could involve the entire IS budget, as was the case when CSC negotiated a contract with General Dynamics.

- Outsourcing could involve management of a network, or the development and maintenance and/or operation of application systems.

If large contracts are negotiated with SO or SI vendors, IS might continue to run a central installation and act as the coordinator or consultant on the vendor activities. Apart from major changes such as those noted above, there are issues about the role of IS in many discrete manufacturers, noted in Exhibit III-4.

- Over a period of time, the decision-making power of IS in relation to application systems has been shared more and more with user groups, according to both user and IS respondents.

- It has also been reported that outside vendors have taken a larger role in technical expertise and knowledge of industries and applications.

The role of IS in discrete manufacturing is shifting toward that of administrator, facilitator and advisor, while the roles of users and vendors become more significant, as shown in Exhibit III-5.

- In the past, the monopoly of IS knowledge, combined with a centralized approach to the use of IS and the complexity of hardware and software used in discrete manufacturing, supported a reliance on IS executives and organizations.

- Users described their needs, justified projects when called upon and accepted systems.

- Vendors were called upon by IS to supply software products and personnel to aid with systems work.

The change in this paradigm occurred as users learned more about IS equipment through college and work experience. They were also forced to learn more about the use of IS in order to improve the productivity of their functions.

Advances in technology and in vendor capabilities aided in this change.

- Technology that allowed users improve their department and local functions began to focus attention on the contribution that users could

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make. Advancements that made equipment and software products easier to use expanded the impact that users could make.

- Vendors found that the increasing amount of knowledge they have gained of industries and applications could be of great advantage to users. They found that their expertise and capabilities could be sold more easily to users when combined with functional knowledge of the business.

EXHIBIT III-5

Shifting IS Role

Former Roles	Evolving Role
IS Role • Needs description • Specific development alternatives • Development, implementation • IS operation • HW, SW, telecommunications expertise • High-level consulting	IS Role • Needs recording • Assistance with specifications justifications and problems • Possible supplier or contractor • Possible operator • Documentation and administration
User Role • Needs survey • Justification • Acceptance • Possible operator	User Role • Needs development • Decisions on suppliers, contractors • Possible contractor
Vendor Role • Supplier	Vendor Role • Technical expertise • High-level consulting • Possible contractor/supplier • Operator

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The result has been that users have emerged as the driving force in the use of IS, and the IS department is becoming more occupied with the necessary functions of recording, documenting, keeping track of activities and standards, and administering the processes concerned with planning and using information systems.

Vendors are more able to bring their capabilities to the attention of users and executive management.

- Vendors are expected to be a source of knowledge about how automation should proceed.

- IS may be a part or the leader of a team that includes vendors, or it may be an advisor, team member or documenter for a user that is having a vendor handle a project.

C
Impact of Newer Technology

Apart from the business forces affecting information systems in the discrete industry sector and the shifts being made in budgets as the result of business and user pressures, there are technological factors impacting the IS environment.

- In some companies, the IS staff has been involved and/or the IS budget has supported robotics in warehouse and factory floor automation and the use of new bar coding technology in material movement, inventory management and product delivery.

- IS has also felt an increasing technological impact from requests to interface to the networks and applications of suppliers and customers.

Trends in the use of technology that have had major impacts on the IS environment according to IS managers and user respondents are listed in Exhibit III-6. The ranking emphasizes the impact of client/server use or cooperative processing, as several respondents referred to it.

- One of the reasons for interest in this type of use is that it provides the means for integrating separate functions that are using redundant data. Design or customer service groups can access files of product specifications and information used by manufacturing systems for use in their own work rather than maintain separate files.

- An important second reason is that client/server applications can provide means of modifying or improving the performance of major manufacturing systems without rewriting them. Several large manufacturers report that they are using client/server systems to access and use data on main-

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frame MRPII application systems as well as to take over segments of work.

EXHIBIT III-6

Major Technological Trends

Trend	Relative Importance Reported
• Client/Server Use	4.4
• Downsizing	3.9
• Use of Upgraded and Integrated Systems	3.8
• Use of Open Systems/UNIX	3.8
• Network Applications and EDI	3.7
• Image Processing	3.2
• New CAD/CAM Capabilities	3.0

Rating: 5 = high, 1 = low.

The use of client/server technology is raising many challenges, however.

- It can add to the technical knowledge required by users, although users are more likely to learn about IS technology when it is being used in their local functions. Vendors also provide software products with graphical interfaces and other aids as well as professional services aid that can expedite the learning process.

- However, the use of client/server technology can raise questions about the integration of activities or functions split among client/servers and other computing capabilities, overall strategies for upgrading manufacturing, and architectures to be considered in automation plans.

- It can also raise issues about the need for standards and the use of open systems to communicate among equipment.

Together with the use of client/server technology, downsizing and other technology, the use of open systems and UNIX is one of the major technological trends reported in Exhibit III-6.

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- Respondents mentioned that the goals of interoperability and portability are being addressed in many environments by obtaining workstations that use a UNIX operating system, and software products, including data bases and application products, that can be used with UNIX.

- Multiple versions of UNIX are in use, however, and other approaches are also being used or suggested for open systems, such as OS/2, versions of DOS, and the CIM/400 product of IBM.

- Other approaches to open systems could also be developed that are better suited to discrete manufacturing or manufacturing as a whole.

- IS departments in the discrete industry must maintain awareness of alternatives and also become involved with UNIX and any other approaches to open systems that user groups in their companies consider or start using.

Open systems is much more than UNIX, and a full strategy is required. It cannot be a casual approach if long-term use and integration are planned.

The use of upgraded and/or integrated manufacturing systems, including CIM (whether partial or full), is reported as a technological trend at a number of discrete manufacturers.

- GM is developing an integrated scheduling system that will replace 30 separate scheduling systems.

- Deere is upgrading the operation of its MRPII system with a client/server-based planning system that will speed up its operation.

A number of manufacturers are considering or beginning to upgrade their manufacturing systems so that they can use relational data bases or data servers that will permit integration with or interfaces to more application areas within companies.

- Vendors are responding to the need for expanded interfaces by upgrading their manufacturing software products so that they can use a common relational data management capability.

- Some vendors and companies are referring to this capability as enterprise resource planning, because it provides a wider view of the organization that includes MRPII, plant floor scheduling, quality management, sales and order management and other functions.

The use of open systems, particularly UNIX, and graphical user interfaces is being promoted for this capability, although the approaches of individual vendors may not be fully compatible. There are also proprietary approaches to this goal being taken by IBM and other vendors.

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The manufacturing system that has just been introduced by Oracle will interface to 19 application areas, including business, engineering and shop floor areas. ASK will have competitive capabilities under the name Advance in the near future.

The basic goal of integrating systems, particularly CIM, has been questioned by recent studies.

- Although there are benefits, the payoff has not recovered investments at many companies.

- The involvement of users in more functional areas and their participation in automated systems through client/server capabilities may be needed, as well as more comprehensive planning.

Downsizing is also mentioned as a technological trend because there is interest in distributing capabilities to areas that can manage them better, and in reducing mainframe and data center expenditures by IS users and corporate management.

- Downsizing of segments of application systems have been reported by Intel, Motorola, GE and other manufacturers recently.

- The use of a moderately priced parallel processor rather than a mainframe to interconnect manufacturing functions at GM could also qualify as a step toward downsizing.

The expansion of network applications, particularly EDI, was mentioned as a trend by a number of respondents. The use of EDI has grown in importance as many companies recognize it can improve service as well as save costs.

The use of image processing is another trend that is recognized in discrete manufacturing.

- Integration of image and data processing has been introduced in regard to product and engineering documentation in a number of companies.

- Image processing has also been introduced to aid customer service and marketing.

The use of CASE and CASE tools was also mentioned as a technology of interest, but it remains uncertain whether its use is a true long-term trend.

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IV

Information Services Market

This chapter, which will discuss the discrete manufacturing market in detail, is divided into the following sections:

- Market Overview
- Environmental Factors
- Expenditures by Delivery Mode
- Expenditures by Island of Automation
- Vendor Analysis

A
Market Overview

1. Introduction

As a whole, the manufacturing market is larger than all other sectors of the U.S. information services industry. By itself, discrete manufacturing ranks just behind banking and finance, in second place in the U.S. economy.

Manufacturing covers the production of a wide range of products, from space vehicles to clothes, jewelry and petroleum products. The manufacturing market is divided into two sectors, discrete and process, on the basis of the goods produced. The subsectors of discrete manufacturing and process manufacturing are listed in Exhibit IV-1.

INPUT's definition of discrete and process manufacturing conforms closely with the U.S. Standard Industrial Classification (SIC) system. The only exception is petroleum, which the SIC manual classifies as an extractive industry and which INPUT considers part of process manufacturing.

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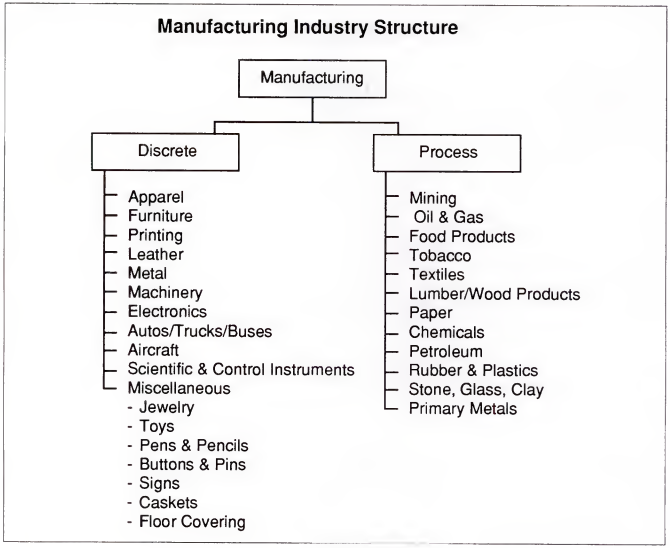
EXHIBIT IV-1



2. Market Structure

The discrete market can be analyzed by dividing it into product groups such as durables, nondurables, information products and style goods. INPUT has tentatively divided the market into six submarkets in order to analyze the use of information systems further:

- Automotive
- Aerospace
- Machinery/metal
- Electronic/radio
- Medical/instrument
- Other

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The components of discrete manufacturing previously discussed can be assigned to these submarkets, as shown in Exhibit IV-2.

EXHIBIT IV-2

Discrete Manufacturing Submarket Components

Market Segment	Components
Automotive	Automotive, truck, bus, train
Aerospace	Airplane, space, missiles
Manufacturing/Metal	Machinery, metal products
Electronics	Electronics, radio detection
Medical/Instruments	Medical equipment, dental equipment, laboratory instruments
Other	Apparel, furniture, leather, jewelry, toys, sporting goods, printing, publishing, all else

These submarkets differ from each other to some extent in the factors that drive their use of information systems.

- Defense contracts and the reporting that they require, as well as the complexity of manufacture, have been significant factors in the use of information systems in the aerospace industry.

- The automotive market has been driven by pressure from foreign competition as well as by the recession's effect on buying.

Although there are exceptions, the first three submarkets have generally implemented the most advanced information technology applications, although some companies in the printing and publishing business have been involved in new developments, including Dow Jones & Company, Knight-Ridder and several leading magazine publishers. Dow Jones installed satellite-based information transmission systems in the early 1980s.

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3. Market Segmentation

The discrete and process manufacturing sectors and the discrete submarkets can be further segmented into key applications areas, or islands of automation:

- Business
- Engineering/design
- Factory floor

These areas and overall system environments that address them will be discussed in more detail in Section D of this chapter.

B
Environmental Factors

1. Driving Forces

The forces that information services vendors report as driving their activities and growth in the discrete market are shown in Exhibit IV-3.

- These forces correlate in general to the forces that users reported, discussed in the last chapter, except that users gave slightly more emphasis to service, sales support and cost reduction.

- Vendors who responded to the issue tended to associate these forces with all submarkets of discrete manufacturing, but felt that the first three forces had more of an impact on the automotive and electronic submarkets.

Vendors note that domestic car manufacturers, particularly the three major car makers, are all pursuing plans to upgrade systems to improve service and quality, driven by overseas as well as domestic competition.

- Domestic competition now includes the activities of transplants such as Toyota, which is investing strongly in information systems in order to increase service and quality.

- A number of other companies, such as The Stanley Works, have also invested in application systems to improve quality. Stanley's investments in warehouse management, MRPII, sales management and EDI systems have all been associated with the objective of improving quality.

Not all companies or subsectors, however, are investing at a high level in IS in order to improve quality, as noted by a recent study in which Ernst & Young participated.

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EXHIBIT IV-3

Forces Driving IS Strategies of Vendors Serving Discrete Manufacturing

Force	Level of Importance
• Improve Services	4.6
• Reduce Costs	4.4
• Improve Quality	4.1
• Provide Users with Connectivity/Processing	4.0
• Upgrade/Integrate Application Systems	3.9
• Interconnection to Clients and Suppliers	3.7

Rating: 5 = high, 1 = low.

Vendors also recognize that the drive to reduce costs is strong in many companies across all submarkets that have been discussed. One reason for this is the debt burden that companies have been carrying.

- One of the objectives of the recent outsourcing contract at Subaru America was reported to be cost savings.
- An objective of the downsizing program at GE Nuclear is to save on future costs as well as provide a means of having users more involved in work functions.

Vendors of information services are very responsive to the need for more connection with internal and external entities in discrete manufacturing, and believe that this is driving the use of their services.

- Providing users with more capabilities for improving their operations by accessing and manipulating data in other automated functions is occurring throughout discrete manufacturing.
- Being able to supply and obtain data to and from suppliers and customers can also drive user expenditures for information services to improve performance and service as well as reduce costs, vendors report.

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The forces just reviewed encourage the consideration of certain technologies, according to information services vendors. The technological considerations mentioned most frequently include:

- Integration of applications, data bases and networks
- Network, LAN and client/server use
- Relational data bases, and the capability to handle expanded application systems
- Downsizing
- Open systems and/or standards

Information services vendors and users are not far apart regarding the factors of importance to users in selecting information services vendors, shown in Exhibit IV-4.

- Users emphasize industry and application knowledge more than some vendors appreciate, however.
- Users also stress project management to a greater extent and certain technological skills less than some vendors do.

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EXHIBIT IV-4

Selected Evaluation Factors for Information Services Vendors in Discrete Manufacturing

Factor	Average Rating by Users	Average Rating by Vendors
Industry Knowledge	4.9	4.3
Application Knowledge	4.6	4.3
Reputation	4.6	4.4
Technical Expertise	4.2	4.6
Similar Experience	4.1	4.0
Project Management Skills and Methodology	4.1	3.5
Use of UNIX, CASE, AI, or Other Technologies	2.7	3.2

2. Growth Inhibitors

Exhibit IV-5 identifies the key inhibitors to growth in information services expenditures identified by vendors.

Reduced and limited budgets due to economic conditions is an inhibiting factor at many companies, according to vendors.

- This does not mean that all spending is curtailed, but limitations on what can be done must certainly be considered.
- This factor can encourage the use of client/server solutions and downsizing rather than mainframe solutions, because less cost will probably be involved. However, the question of whether these solutions are the best alternative or are carried out in relation to strategic business application planning or architectural plans for technology use may not be considered in view of cost constraints.

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Lack of interconnection between different functions as well as between islands of automation, such as the factory floor and business units, can be an inhibiting factor to the products and services of some vendors, although others regard it as an opportunity.

The lack of an overall plan for achieving an integrated environment through information technology can inhibit development work but can provide an opportunity for some information services vendors.

Lack of specific technical expertise can also be a difficulty at times and is one reason a number of vendors have developed alliances with each other.

The involvement of more parties in decision making can also be an inhibiting factor for vendors, as noted in Exhibit IV-5.

- Increasingly, major IS purchase decisions are moving away from the chief information officer (CIO).

- User committee members are often more important as decision makers. However, as committees include more users, organizations may find it difficult to move rapidly.

Information services vendors may need strategies to speed up decisions. These may include demonstrations of working solutions, as used by Andersen, prototypes of manufacturing operations such as those used by Computer Associates, or the ability and experience to walk through functions practiced by a number of vendors, to bring matters to a decision.

The strategies mentioned above can also aid in relation to another inhibitor: the growing need to acquire solutions to ever more complex system requirements. As needs become more complex, more users can become involved and find it necessary to visualize solutions with more clarity.

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EXHIBIT IV-5

Growth Inhibitors to Information Services Use

Inhibitor	Degree of Importance to Vendor Respondents
• Reduced/Limited Budgets	4.9
• Lack of Interconnection between Functions	3.7
• Lack of Overall Planning	3.4
• Involvement of More Parties in Decision Making	3.2
• Lack of Technical Expertise	2.4

Rating: 5 = high, 1 = low.

C
Expenditures by Delivery Mode

1. Overall Expenditures

As shown in Exhibit IV-6, 1992 user expenditures for information services in discrete manufacturing will reach $13.1 billion, an increase of 12% from 1991 user expenditures of $11.9 billion.

- Between 1992 and 1997, it is projected that user expenditures will continue to increase at a compound annual rate of 12%, reaching $22.9 billion in 1997.

- Among all industry sectors tracked by INPUT, discrete manufacturing is in second place, close behind banking and finance. Discrete constitutes more than 25% of the expenditures among the top five industry sectors.

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EXHIBIT IV-6

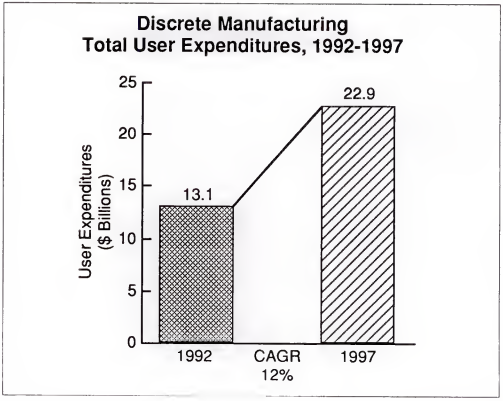

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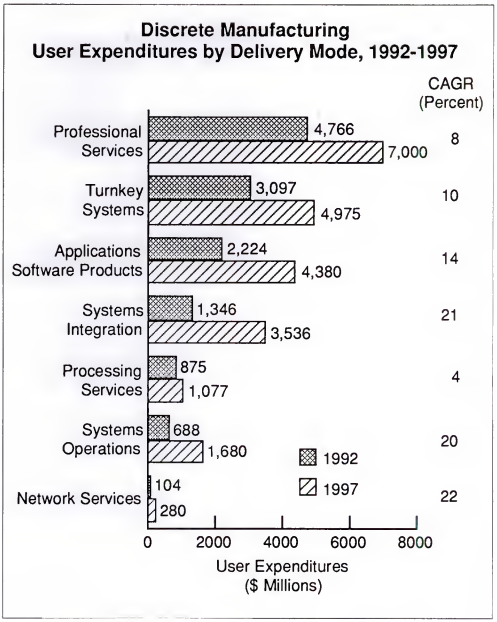
Exhibit IV-7 divides the discrete manufacturing sector into INPUT's seven delivery modes.

EXHIBIT IV-7



2. Professional Services

Professional services has the largest amount of user expenditures among modes of service in discrete manufacturing, and will maintain that lead in 1997 when it will amount to $7.0 billion. However, it is one of the slower growing modes, at an 8% CAGR.

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- Professional services includes software development and enhancement work performed by a large number of vendors of various sizes, consulting work performed by a smaller number of sizable vendors in most cases, and education and training work performed by a small number of vendors that includes both very large and very small vendors.

- Consulting work is the fastest growing submode of professional services, increasing at a CAGR of 14% through 1997 and driven by the need for strategic and information technology planning.

- Systems development is still the largest submode of professional services, although it is growing at a low CAGR of 5%. This is due to some extent to the fast growing use of systems integration as a development alternative, as well as greater use of applications software products, particularly for workstations, to meet systems needs.

- Professional services work often relates to specific application systems. Application development and maintenance is carried out as part of systems development work, and application management activities are carried out as part of consulting services.

Discrete manufacturing remains a major factor in the professional services market. At $4.8 billion in 1992, it represents over 25% of the total professional services business, which explains why so many large vendors in the business offer services to the discrete industry.

3. Applications Software Products and Turnkey Systems

The discrete manufacturing sector is a good target market for applications software vendors.

- The use of applications software products will grow at a CAGR of 14% as shown in Exhibit IV-8, driven by a CAGR of 24% for workstation/PC products.

- In the applications software area, users spend more for minicomputer-based software products than for mainframe- or workstation/PC-based software products combined. However, Exhibit IV-8 indicates a changing pattern of user expenditures; organizations will purchase significantly more applications software products running on workstations/PCs by 1997.

In turnkey applications, the advance of the workstation/PC has been even more pronounced, but it was mitigated in the applications software products categories by the continued utility of the minicomputer in some applications, such as production control and factory floor.

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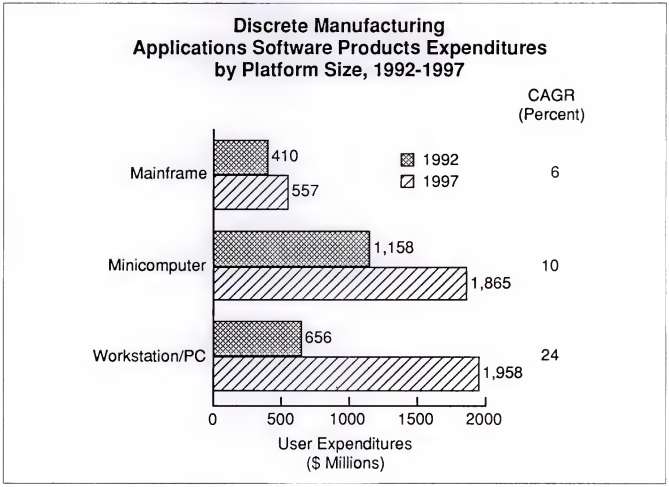
- The use of workstations in client/server applications has changed the picture significantly and is helping to fuel the rapid growth of applications software products for workstations.
- The expanding use of workstations in engineering and CAD/CAM applications is also of interest in discrete manufacturing, but not all expenditures for these applications are included in industry totals, because they are cross industry in nature.

EXHIBIT IV-8



U.S. Census Bureau statistics from recent years suggest that sales of applications software products may be higher in the automobile, electronics/instruments, and aerospace submarkets than in machinery and other markets.

INPUT believes that large manufacturing companies will increase spending for applications software products relative to medium and small company spending because of the greater relative magnitude and complexity of their operations.

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- Although there are about 70 times as many small manufacturing companies as large ones, they do not add up to a meaningful fraction of the opportunity that larger companies provide.

- Smaller companies have not advanced as far in automation, generally, as larger discrete manufacturers, but they do offer opportunities for turnkey and software product solutions.

4. Systems Integration

Growing at a CAGR of 21% through 1997, when it will reach a level of nearly $3.6 billion, SI offers a significant opportunity in the discrete manufacturing industry.

- By 1997, the annual increase of SI business will be greater than the corresponding increases of professional services or applications software product businesses.

- SI also presents an opportunity to secure a contract for a longer period of time. Large and fast growing vendors such as Andersen Consulting, EDS and CSC have capitalized on SI business in the discrete manufacturing industry, where companies are seeking the aid in industry and application knowledge that these vendors have prepared themselves to provide.

5. Processing Services and Systems Operations

In 1997, transaction processing services in discrete manufacturing will be a $1.1 billion market, but it is growing at the low CAGR of 4%. Reasons for large transaction processing expenditures include:

- The use of supercomputer networks for sophisticated engineering and design processing

- The use of processing services with large networks to handle processing for scattered locations and customized backup and disaster recovery facilities

Systems operations, for which expenditures are smaller than for processing services at this time, is growing at a much higher CAGR and will surpass processing in volume in 1994.

- The systems operations CAGR from 1992 to 1997 is forecast to be 20%, which will result in $1.7 billion of user expenditures in 1997.

- The SO mode of service provides the means for users to obtain the expertise and economies of scale that large vendors can provide in the operation of their equipment or in the management of their application systems without making large investments.

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6. Network Services

Although the components of network services are growing rapidly in discrete manufacturing, the total market will amount to only $280 million in 1997.

- Electronic data interchange (EDI) has been a major influence upon the size and the CAGR of 24% for network applications in discrete manufacturing. EDI applications will increase by about 50% during the forecast period.

- Expenditures for electronic information services will also grow at a high CAGR of 20% between 1992 and 1997.

D
Expenditures by Islands of Automation

This section will evaluate user expenditures based on INPUT's model of islands of automation:

- Business
- Engineering/design
- Factory floor

Key application systems within business include manufacturing resource planning (MRPII), material requirements planning (MRP), and inventory management. Engineering includes computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM) applications. Factory floor encompasses shop floor control, numerical control machine products, and robotics.

- Business and engineering/design applications together account for about 80% of user expenditures in discrete manufacturing. The use of all CAD applications is not included, because many are cross industry in nature.

- INPUT's user expenditure sizing of the factory floor application includes computer-aided manufacturing, numerical control, process control, and shop floor control. INPUT's definition excludes metalworking equipment, programmable controllers, automatic inspection systems, and material-handling systems.

User expenditures have varied widely by application system and submarket within each island of automation.

- For example, the MRP application has been widely implemented in aerospace and automotive, but is used less in electronics.

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- MRPII, with higher average selling prices than MRP applications, accounts for significant revenue in the business island of automation, particularly in the automotive industry.

- Within the engineering/design island of automation, electrical engineering/electronic design products and services account for most user expenditures, followed by computer-aided design (CAD) and mechanical engineering products and services. These products and services have penetrated the aerospace and automotive industries most.

Historically, discrete manufacturing has had a relatively large installed base of order entry, purchasing, and inventory management software products.

- More than ten years ago, when minicomputers showed the greatest cost effectiveness in financial applications, software and turnkey vendors seized that opportunity.

- Engineering/design applications were developed primarily in-house, although software and turnkey products have been introduced widely for that purpose in recent years.

- Factory floor applications were also originally developed in-house in the past, due partially to the lack of standards.

Historical opportunities for software products vendors most likely led them to concentrate resources in the financial area.

- Recently, software and services vendors have expanded further into the other islands as well as into approaches for integrating application systems and achieving CIM.

- Most of these approaches have only succeeded in partially linking the three islands of automation.

E
Vendor Analysis

Analysis of vendor revenue reveals that the combined market share of the top ten vendors from 1985 through 1992 has dropped from 18% to about 12% during this period, as shown in Exhibit IV-9.

- Allowance must be made for the fact that much of the revenue from GM is no longer counted, since it is captive, and some categories of applications are not counted at present because they are cross industry. Total vendor revenue has also increased by more than 213%.

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- Despite the allowances mentioned above, the business of the top 10 vendors is over twice as high in dollar terms in 1992.

EXHIBIT IV-9

Discrete Manufacturing Combined Market Share of Top 10 IS Vendors, 1985-1992

	Market Size ($ Billions)	Market Share (Percent)
1985	6.2	18
1992	13.1	12

The division of user expenditures by vendor categories has been changing.

- Computer manufacturers have increased their share of the discrete business by providing more professional services, software products and turnkey systems than was previously the case. Also, manufacturers have been very active in providing the newer, fast growing SI and SO business.

- Firms outside of the information services industry—including Big 6 firms such as Andersen Consulting and Coopers & Lybrand as well as companies that have bought information services firms, such as GM—have increased their share of the discrete manufacturing industry.

- Dedicated turnkey vendors have a decreased share of the discrete business because some of them have been bought by computer manufacturers, suffered falling business or have concentrated more on cross-industry business. Also, computer manufacturers and software product and other vendors have all begun to compete for turnkey business.

- Independent software and processing/network services vendors continue to hold shares of the industry business.

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V

Competitive Environment

A
Introduction

This chapter presents detailed information on IS vendors serving the discrete manufacturing sector. The chapter is divided into the following sections:

- Leading IS Vendors
- Mergers and Acquisitions
- Vendor Profiles

INPUT conducts extensive analyses of vendor revenues. In order to present useful and accurate information for the discrete manufacturing market, U.S. revenues were subtracted from total revenues, and revenue was split between discrete and process manufacturing sectors in instances where an IS vendor served both sectors.

B
Leading Vendors

Exhibit V-1 presents the market shares of the leading applications software products companies serving the U.S. discrete manufacturing sector.

- This exhibit illustrates that applications software products are produced by companies that are only software vendors as well as by computer vendors and companies in other industries that have acquired software product firms.

- Just as other types of vendors have entered the software products market, many software firms, including ASK, System Software Associates, American Software, Dun & Bradstreet and particularly Computer Associates have added professional services work. Much of this work is involved with customization and enhancement of software products, but some assignments include consulting, training and small development tasks.

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EXHIBIT V-1

Leading Applications Software Products Vendors in Discrete Manufacturing*, 1991

Vendor	Market Share (U.S.)
ASK	6
IBM	4
Dun & Bradstreet	4
Cadence	3
Groupe Bull	3
System Software Assoc.	2
Computer Associates	1
American Software	1
Cincom	1

*Most CAD/CAM and other cross-industry not included.

Some CAD and other cross-industry software products are not considered in this list because they are not specific to discrete manufacturing. Vendors such as Cadence that address only specific areas of the discrete manufacturing market are included, but the products of Intergraph and other vendors, including CADAM, are not included since they are cross industry in nature.

Although much of the revenue is cross industry, CAD/CAM is also the leading application product for turnkey systems in discrete manufacturing today, as it has been for over two decades.

- The tightly coupled requirement for CAD applications software and high-performance graphics makes CAD/CAM one of the strongest uses for turnkey systems in discrete manufacturing.
- With the acquisition of CADAM from Lockheed, and the shipment of the RS/6000 in 1990, IBM became a significant factor in this market.

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Computer manufacturers have become important in the turnkey delivery mode by obtaining CAD/CAM and other products to sell with their computing equipment.

- Prime acquired CAD/CAM products, just as IBM did.
- Prime has also implemented the Pick operating system to support manufacturing and distribution programs available in the Pick world.

Vendors of turnkey products that have industry-specific solutions for the discrete industry include Prime, ASK, EDS, Hewlett-Packard, SAP and a number of vendors with very small market shares.

Exhibit V-2 presents the market shares of professional services vendors in discrete manufacturing.

- The vendors offering this service are diverse, including Big 6 firms, subsidiaries of aerospace and other industrial firms, computer hardware firms, and vendors devoted to professional services.
- The leading two vendors in this mode are professional services vendors.

Because the professional services market is the largest mode in discrete manufacturing, and there are no vendors with a market share of significant size, it is evident that there are many vendors with small amounts of professional services work.

- Some of the work is being done by firms in other modes, including software products and turnkey systems.
- There are also a number of contract services vendors that operate as agencies that supply personnel for professional services assignments.

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EXHIBIT V-2

Leading Professional Services Vendors in Discrete Manufacturing, 1991

Vendor	Market Share (U.S.)
Computer Task Group	2
Analysts International	2
Andersen Consulting	1
IBM	1
EDS	1
Coopers & Lybrand	1
AGS	1
Groupe Bull	1
Hewlett-Packard	1
A.D. Little	1
Computer Sciences	1
CGA	1
NCR	1
Computer Horizons	1
Ernst & Young	1

As shown in Exhibit V-3, the ten leading vendors of systems integration control a larger share of the total market than is the case with professional services (31% versus 12%).

- The SI market is growing much faster and has higher margins of return than professional services in general. It is more likely that vendors will fight for larger shares of this market.

- The SI market is also harder for the agency-type firms to place people in who have been terminated or who are foreign nationals. Knowledge of industries and experience in implementing solutions to complex problems are differentiating features of SI firms.

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EXHIBIT V-3

Leading Systems Integration Vendors in Discrete Manufacturing, 1991

Vendor	Market Share (U.S.)
Andersen Consulting	10
CSC	4
IBM	4
DEC	3
Coopers & Lybrand	2
CGA	2
Deloitte Touche	2
EDS	2
CTG	1
KPMG	1
Price Waterhouse	1
TSC	1

Exhibit V-4 presents a list of leading systems operations vendors and market share information.

- The four vendors that lead this list are the largest vendors in the information services industry. These vendors have choices about the modes of service they can offer, in view of their size and penetration of other modes. They have chosen to gain market share in this mode due to the long contracts, add-on work and margins that are involved in systems operations.

- The smaller two vendors listed in V-4 are two of the leading smaller vendors active in this mode, indicating that the opportunities available in systems operations are being taken advantage of by smaller vendors also.

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EXHIBIT V-4

Leading Systems Operations Vendors in Discrete Manufacturing, 1991

Vendor	Market Share (U.S.)
EDS	17
CSC	4
IBM	3
Andersen Consulting	2
Genix	<1
Litton	<1

Exhibit V-5 lists selected merger and acquisition activities and alliances occurring among IS vendors serving the discrete manufacturing sector. These alliances illustrate how vendors serving this sector attempt to strengthen their positions.

- EDS has pointed out that its acquisition of the McDonnell Douglas SI company strengthened its position in manufacturing.
- Computer Associates added to its systems software and manufacturing capabilities with the acquisition of Pansophic. CA has already strengthened the marketing of Pansophic manufacturing software products by adding a means of reviewing capabilities and planning installation for the use of prospects.

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EXHIBIT V-5

Illustrative Acquisitions, Mergers and Alliances Among Vendors Serving Discrete Manufacturing

Acquirer (or Ally)	Acquired/Merged (or Ally)
Computer Assoc.	Pansophic
EDS	McDonnell Douglas SI Company
Coopers & Lybrand (Ally)	NMI (Ally)

C
Vendor Profiles

Profiles of a number of different types of information services vendors active in the discrete manufacturing industry are presented in this section. The strategies, background, and products and services of these vendors are reviewed to illustrate the range of competition in the industry.

Some vendors active in discrete manufacturing concentrate on a limited set of capabilities in one delivery mode or industry.

- GEIS provides EDI and VAN network applications services to discrete manufacturers and other industries.
- Gerber Scientific provides CAD/CAM turnkeys to companies in a range of discrete manufacturing markets.

Other vendors are focusing on information services products and services that can meet a wider range of needs of prospects.

- Andersen Consulting, Coopers & Lybrand and other Big Six firms are attempting to meet a wide range of needs in a number of areas of discrete manufacturing as well as in other industries.
- Through the acquisition of MDSI, EDS announced that it had strengthened its ability to offer a wide range of services across discrete manufacturing.

The larger vendors serving the discrete manufacturing market also serve a number of other markets, as illustrated by the vendors that have been

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mentioned above. There are many small vendors such as Symix and Factorial Systems serving only the discrete manufacturing market or only discrete and process manufacturing customers.

In addition to the companies that are profiled, many other information services vendors serve the discrete manufacturing market, including IBM, NCR, DEC, and GEIS.

Companies that are profiled include:

- Andersen Consulting
- American Software
- ASK Computer Systems
- BT Tymnet
- Computer Task Group
- CACI
- Dun & Bradstreet Software
- Factorial Systems
- Sterling Software, Inc.—EDI Group
- Symix

Additional information about these companies or other companies active in discrete manufacturing can be found in the VAP Program of INPUT

1. Andersen Consulting, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602

a. Company Strategy

Andersen supported its reputation as a leading information services vendor in manufacturing by announcing one of the largest client/server projects thus far undertaken by a vendor, begun in 1992 for a manufacturing client. Andersen utilizes its reputation and demonstrations of working solutions to manufacturing and distribution problems as a means of appealing to and closing business with prospects who are solution oriented. Attention is focused on manufacturing, but is also given to retail and wholesale distribution and to banking, utilities and other markets.

Andersen emphasizes its knowledge of industries and applications to make presentations and conduct consulting studies that can lead to large SI and professional services contracts. In addition to these services, Andersen has sold its manufacturing software products through a VAR.

By studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings to companies that it contacts. The firm uses acquisitions and alliances to gain knowledge and additional resources that address its areas of interest.

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b. Company Background

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its rapidly growing and large volume of information services business. Estimated worldwide revenues in 1991 for Andersen Consulting were $2,650 million, about 25% above the revenue for 1990. U.S. revenues increased by about 9% to $1,345 million in 1990.

c. Key Products and Services

Over half of 1991 revenue was derived from systems integration and about 25% was from professional services. Systems operations revenue was about 8% of revenue in 1991, and revenue was also obtained from applications and systems software products and network services.

Areas of manufacturing expertise include CIM, CAD/CAM, MRPII, robotics, material handling, numerical control, bar code data collection and change management control.

2. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305 (404) 261-4381

a. Company Strategy

American Software derives both applications software and professional services revenue from an integrated line of standard applications software products for IBM mainframe and AS/400 platforms. These products were designed to run singly or in combination to meet unique customer requirements.

- These products have been supplemented to meet the needs of installations in cetain industries, particularly manufacturing.

- American Software will perform professional services work to customize its software products to solve customer problems.

In addition to a set of manufacturing modules, American Software can offer a full MRPII system for IBM mainframes and minis.

b. Company Background

American Software was founded in 1970. The company grew to around 750 full-time employees in 1990, and its calendar-year revenues for 1991 were over $100 million, with about $90 million in revenue from the U.S. The company provides both applications software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation and government clients.

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c. Key Products and Services

About 37% of American Software's revenues are provided by professional services and 13% from maintenance of software products, which could be included as part of professional services.

- As shown above, about half of the company's revenue is from professional services.

- American Software is one of the most successful software vendors in marketing professional services.

The applications software products it sells can be divided into two groups:

- Forecasting and inventory management software that accounts for about 8% of revenue

- Purchasing, materials control and financial software that accounts for about 38% of revenue.

Specific manufacturing modules include master scheduling, materials requirement planning, bill of material, capacity planning, production work status, shop floor control and cost management and tracking.

3. ASK Computer Systems, Inc. 2240 W. El Camino Real, Mountain View, CA 94039-7640 (415) 969-4442

a. Company Strategy

ASK is the largest vendor offering chiefly software products to the manufacturing industry. ASK projects the image of a vendor that understands manufacturing and has a full set of products that can meet needs. It concentrates on offering an on-line, interactive system (the MANMAN Information System) of integrated modules that can meet the needs of many discrete or process manufacturers.

- Modules are available for manufacturing, finance, marketing, customer service, decision support and computer-integrated manufacturing purposes.

- The software products are available in turnkey solutions, software products for HP, IBM, and DEC midrange computers, and on a processing service.

ASK has recently announced its support of Enterprise Resource Planning, an enterprisewide approach to information systems use that facilitates the integration of current and new systems. Building on MRPII core systems, this approach makes it possible to collect and use information from hetero-

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geneous environments and promotes the distribution of functions to user areas through client/server technology.

b. Company Background

ASK was incorporated in 1974 to serve the manufacturing industry. Its early acquisitions supported the platforms, software products and clients that it had in manufacturing. Its acquisition of Ingres in 1990 brought in new types of clients and customer problems, although it also brought ASK the resource necessary to address the increasing integration of functions in manufacturing, a relational data base.

Information services revenues in the U.S. are now above $240 million on a calendar-year basis.

c. Key Products and Services

As noted above, ASK has an on-line set of manufacturing software modules that run on mini platforms as well as a relational data base capability. ASK is also developing and will introduce in 1992 an open system set of modules that will facilitate the integration of functions and support the Enterprise Resource Planning approach to business described above.

4. BT Tymnet, Inc. 2560 North First St., San Jose, CA 95131 (408) 922-0250

a. Company Strategy

BT Tymnet is in business to be one of the world's largest providers of a wide range of shared, dedicated and hybrid network solutions. The company operates the TYMNET public packet data communications network and provides access to dial-up services, major on-line data bases, EDI services, card authorization/electronic data capture and other services in support of its strategy.

BT Tymnet has taken actions to penetrate manufacturing, distribution, warehousing and other industries where EDI business could grow.

b. Company Background

The TYMNET data network was initiated in 1969 to support remote processing services to timesharing clients. In 1977, it became an FCC-regulated specialized common carrier, and was acquired by McDonnell Douglas in 1984. In 1989, it was acquired by British Telecom plc together with a value-added service provider active in Japan. These acquisitions—with Dialcom, acquired in 1986—were organized as BT Tymnet, a subsidiary of British Telecom, in 1989.

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c. Key Products and Services

The TYMNET network consists of intelligent communications processors and network capabilities that allow clients to communicate between attended or unattended terminals and their own or other computers in a variety of different locations. A number of different protocols, error correction, protocol conversion, data security and other services are provided by the network. Access to major on-line data bases is also provided through this network.

EDI*Net is the principal EDI service of BT Tymnet, providing third-party value-added communications services for automated exchange of business documents such as purchase orders, invoices and bills of lading. There are over 1,000 clients in the transportation, distribution, manufacturing, and telecommunications industries. A significant discrete manufacturing area of use is the aerospace industry, which is a large user of EDI and other network services.

Credit card and electronic data capture are provided for all major credit cards as well as private label programs.

Private and hybrid data networks are also provided to clients in a number of industries. Ford utilizes a hybrid system combining shared and dedicated equipment and VAN services from BY Tymnet.

5. Computer Task Group, Inc., 800 Delaware Avenue, Buffalo, NY 14209 (716) 882-8000

a. Company Strategy

CTG uses its extensive experience with automated manufacturing application systems as well as its knowledge of suppliers, distribution and other manufacturing functions and problems to assure clients of its ability to meet a range of problems from large, complex jobs to tasks requiring the knowledge of high-level technological skills. Capabilities have been developed to support systems integration and network development and integration activities.

CTG can bring its strengths to bear in a number of industries, including discrete and process manufacturing, business services, banking and finance, insurance, and state and local government. CTG has considerable knowledge of the implementation of MRP and MRPII systems.

b. Company Background

Computer Task Group, founded in 1966, is one of the largest vendors of professional services, concentrating on markets other than the federal government. It provides systems integration services as well as professional services. Its U.S. revenues were about $275 million in 1991.

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In 1989, IBM made an investment in CTG and has used CTG's systems engineers on work for IBM and its clients.

c. Key Products and Services

Over 80% of 1991 revenue was from professional services, and the balance was made up of systems integration work and a small amount of systems operations work. CTG provides consultants experienced in industry problems as well as in technology, which is attractive in discrete manufacturing.

- CTG's staff can augment the staff of a client and become part of the project team on a specific project, or they can manage and staff an entire project.
- CTG has experience in supporting large clients on a single site or multiple sites, domestically or worldwide.

6. CACI International, Inc., 1700 North Moore St., Arlington, VA 22209 (703) 841-7800

a. Company Strategy

CACI utilizes its strengths in advanced information system development, engineering and logistics systems, and simulation systems and modeling to obtain federal government contracts.

In recent years, CACI has been using the strength it gained through government work to provide inventory and warehouse systems to wholesale, retail, manufacturing, and other commercial businesses.

b. Company Background

CACI was founded in 1962 to provide professional and marketing services based on a high level of technology to U.S. and international markets.

About 70% of CACI's business is with the federal government, and includes program management, policy decision support and advanced systems support.

In addition to utilizing knowledge it has gained in government work to obtain contracts to develop inventory and warehouse systems, CACI has engaged in commercial work in support of marketing analysis and planning.

c. Key Products and Services

CACI's services in wholesale and retail distribution and manufacturing include inventory and warehouse management and warehouse automation.

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In addition to consulting and software development, CACI provides implementation work on the robotics used in warehouse automation.

In the federal market, as described above, CACI provides professional and engineering services and simulation and modeling. CACI has one of the leading if not the premier applications software products in use in simulation and modeling of systems, SIMSCRIPT.

Marketing support activities provided on an international basis include market research and demographic consulting.

7. Dun & Bradstreet Software Services, Inc., 550 Cochituate Rd., Framingham, MA 01701

a. Company Strategy

Dun & Bradstreet develops, markets and supports a wide range of industry and cross-industry software products on multiple vendor platforms that provide it the opportunity to market to a number of industries. The company has prepared itself to support the movement from mainframe to mini, workstation and client/server solutions. Application products for use in manufacturing inlude:

- Applications software products are available for financial and accounting, human resources, administrative, purchasing, inventory, manufacturing, education and health industry functions. Many of these products are used in manufacturing, since manufacturing accounts for 45% of company revenues.

- The AMAPS systems support both discrete and process manufacturing environments on multiple vendor platforms. A program is available to develop interfaces with the manufacturing software products of other vendors.

In addition to AMAPS systems, discrete manufacturers use Dun & Bradstreet software products for inventory control, human resources, accounting, financial reporting and other standalone applications. Dun & Bradstreet also provides professional services aid in planning, using and customizing software products.

D&B's software products utilize a number of hardware platforms, including IBM, Unisys, DEC, HP and Bull mainframe and midrange equipment.

b. Company Background

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America, which was acquired in 1990, and McCormack & Dodge, acquired in 1983.

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The former had been founded in 1963 and had over 24,500 product installations. The latter, founded in 1969, had over 10,000 product installations.

c. Key Products and Services

This vendor's software addresses a number of functions, as described in the following:

- The Millennium Series supports human resource, accounting and support functions, chiefly on IBM and compatible mainframes, but some products are also available for DEC VAX computers.
- The PLUS series offers accounting and a micro-to-mini link for IBM AS/400s and System /38s.
- Human resources products are available for IBM and compatible PCs.
- The BrightView Series, which allows the use of intelligent workstations and addresses accounting, inventory and budgeting functions, uses IBM mainframe and 9370 computers.
- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframes and minis and HP computers.
- Software products are also available for education, factory operations and other functions.

8. Factorial Systems, Inc., 6300 Bridgepoint Parkway, Austin, TX 78730 (512) 345-1192

a. Company Strategy

Factorial was founded to provide manufacturing control systems solutions. The capabilities it is using to achieve this objective include:

- The expertise and experience of its employees in implementing factory management and control solutions
- Research and development partnerships in the academic environment
- The ability to provide high-level consulting services in addition to software products
- A proven factory management and control software system acquired from Tandem that has been improved and upgraded to provide workflow, material services and labor services capabilities

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b. Company Background

The company was founded in 1985 to provide manufacturing control systems. It operates out of one location and has fewer than 20 people, but has business in other regions of the U.S.

c. Key Products and Services

The software system that Factorial originally acquired from Tandem has been generalized and provided for workstations/PCs running under OS/2 as well as for Tandem computers running under Guardian and SQL.

The system, now called the Paperless Factory System, includes:

- A knowledge-based management and control system that provides on-line tracking, routing, data collection, resource management, quality control, configuration management and interfaces to other systems and equipment

- A material control system that provides just-in-time and traditional methods of inventory replenishment as well as inventory management, control, accounting and other functions

- A time and attendance and labor reporting system that operates on a standalone basis or integrated with the functions listed above

9. Sterling Software, Inc.—EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017 (614) 793-7000

a. Company Strategy

Sterling's EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the company as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as their use of EDI expands. This strategy is supported with education and participation in the largest user group activity in the EDI market.

Markets that the EDI Group has penetrated include wholesale and retail distribution—including grocery, hardware and housewares as well as pharmaceutical, medical/surgical distribution and service merchandising.

b. Company Background

The EDI Group was created in October, 1990 and includes the ORDERNET Services Division, the EDI Labs Division, and an EDI

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International Division, headquartered in London. The REDINET Services Division of CDC was acquired in 1991 and folded into the ORDERNET Division. Fiscal year 1991 revenues were over $30 million, with 85% of revenues coming from the U.S.

c. Key Products and Services

About 55% of the EDI Group's revenue comes from software products and 45% from network services. Both software products and network services are offered though the ORDERNET division to over 2,700 customers in the pharmaceutical, grocery, hardware and housewares, retail, medical distribution, mass merchandising, warehousing, transportation and automotive industries.

ORDERNET provides an on-line network to manage and control the flow of standardized business documents among over 2,000 trading partners.

Services to certain industries are provided through vendors active in those industries. ORDERNET services are made available to hospitals through GTE Health Systems. Services including a data base on drug usage are made available to the medical industry through International Health Applications. Internetwork traffic for the grocery industry is supported through BT Tymnet.

Electronic transmission of chargeback information between wholesalers and pharmaceutical manufacturers is provided in three formats established by national druggists' associations.

Translation between established standards for EDI and other standards in use and between a variety of record formats, as well as support of existing protocols on different hardware platforms, are provided with software from the EDI Group.

A data base service is also available to build on EDI documents, including purchase orders and invoices that trading partners use during business.

Security services, education and software maintenance are also offered in support of EDI products and services.

10. Symix Systems, Inc., 2400 Corporate Exchange Drive, Columbus, OH 43231 (614) 895-0738

a. Company Strategy

Symix has developed and is marketing a turnkey system that meets the needs of "make-to-order" manufacturers. The system, which is called Symix, is an integrated manufacturing control, accounting and financial system.

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Although Symix is sold primarily with IBM and Hewlett-Packard computers, it could be sold with a variety of other equipment.

- The system is written in a 4GL relational data base language and will run on 300 hardware platforms that use the UNIX operating system, including IBM, HP, DEC, NCR, and Sun equipment.

- The system can also be delivered in versions that will run with VMS and DOS and on LANs using Novell's NetView.

b. Company Background

Symix Systems was founded in 1979 to develop and market manufacturing software for minicomputers. The company developed its Symix system in 1986 and began to market it in 1988. Revenue for 1991 rose to $25 million, over 65% above revenue for the prior year. An IPO was offered in March 1991.

c. Key Products and Services

Other than being a VAR for IBM and HP, the company's business is focused on its Symix software product. There was an earlier product of this type that the company sold after it was founded.

The modules of Symix perform the following functions:

- Inventry control and data collection

- Customer order entry

- Product configuration

- Purchasing

- Shop floor control and data collection

- Time and attendance data collection

- Advance manufacturing/MRP

- Engineering change notice

- Accounting and financial management, including payroll and fixed assets

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VI Conclusions and Recommendations

A Industry and Market Conclusions

The current business interests in the discrete manufacturing industry have promoted a high level of interest in several trends emerging in the use of information systems, including downsizing, client/server technology and outsourcing. These trends will have an impact on the use of information services vendors as well as upon the functional organization of activities in the discrete industry.

- The business interests that are promoting this interest are: a need for more interconnection and access to data to improve service; quality of manufacturing and speed of response between manufacturing functions; and a driving need to eliminate redundant files of data with timing and other differences, and redundant steps of processing required to update and use these files.

- The inability to share data between marketing, service and product management, or engineering and manufacturing functions, makes it difficult to respond to product problems, plan field changes or plan upgraded products.

These deficiencies are having an impact upon discrete manufacturing during a time of weak sales and strong international competition from companies equipped with more responsive capabilities.

In a number of discrete manufacturing companies, where functions are constrained by large application systems and the time it takes to enhance or replace them, there is rising interest in outsourcing information systems functions to vendors that have experience in addressing these deficiencies and the knowledge and ability to discuss problems and solutions with prospects.

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- In fact, some of the larger vendors serving the discrete industry, such as Andersen Consulting and EDS, are providing demonstrations and presentations to users that show them how operations can be improved.

- Several vendors of manufacturing software systems now have enhanced means of walking users through solutions to problems, such as the Power Bench product of Computer Associates.

Client/server technology and downsizing have also been found to be of considerable interest in addressing these deficiencies at a grass-roots level. The use of client/server technology is making it possible to collect and store data once and have it available for use by other functions on a timely basis.

- Client/server technology has a high level of penetration in all submarkets of discrete manufacturing, providing a path between activities in business, engineering and factory floor activities. Although its use is early in the life of this technology, the level of interest seems warranted by the promised benefits in information architecture and access.

- Together with downsizing of segments of application processing to functional units, client/server technology makes it possible for tasks to be handled more rapidly and with greater attention, because the results of the manipulation of data can be immediately available in numeric, graphic, image or modeling/decision-making presentations.

The interest in downsizing and client/servers is providing an opportunity for smaller vendors that can provide software products or commercial services to users. Only a small number of the larger SI and professional services vendors have launched strong moves to take advantage of the situation.

B
User Issues and Recommendations

The use of downsizing can cause structural changes in application systems. It has been found that segments of an application can be downsized to a group with a client/server unit and handled more efficiently or with overall improvements there.

- Corporate management in discrete manufacturing should facilitate and observe efforts by user groups to improve performance. These efforts could improve quality, service and productivity as well as indicate directions in which the automation and integration of functions should proceed. This may prove to be more efficacious than using a blueprint laid down by a planning group or vendor that has not been involved in the problems and challenges of work groups.

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- Vendors should also review what is happening in functional groups interested in downsizing and client/servers, in addition to promoting their products, services and industry plans. They could find new vendors in their accounts that are interested in these developments.

To promote this approach and to integrate manufacturing functions, it will be necessary to utilize a relational data base management capability as well as application systems or feeder systems that handle all the functional types of data that can be found in a manufacturing enterprise.

- In larger enterprises, this could entail 19 or more categories of application data, according to vendors such as Oracle and ASK that have addressed the issue.

- The type of capability being envisioned is an approach to computer-integrated manufacturing, or CIM, which is referred to as enterprise resource planning by vendors and users involved in planning its use.

Vendors and IS staffs involved in discrete manufacturing should examine these developments because they could offer further insight into the discrete industry and suggest approaches that should be considered.

Questions have been raised by respected industry groups about the payback from efforts to achieve CIM.

- Efforts that involve getting into application systems and functions in all islands of automation in discrete manufacturing appear necessary to plan means of achieving CIM.

- One of the means of moving further in that direction is through the use of client/server technology and downsizing.

The use of more network capabilities embraces not only the connection of activities within a plant or company, but also connection to the activities of suppliers and customers.

- Between organizations, it would address the use of EDI and the integration of manufacturing activities between companies, including JIT supply and segmented manufacturing.

- The integration of activities between companies has been recommended as a means of responding to the productivity achieved by Japanese firms. It could be the alternative to arrangements with keiretsu in Japanese industry.

Discrete manufacturers and the information services vendors serving them must consider strategic, architectural and resource issues in the use of information systems as the use of networks, client/server applications and downsizing grows.

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- Architectural and resource issues, which include technical expertise and investments in information technology, may make it necessary to consider the question of outsourcing to a larger extent or using a vendor in a partnership arrangement.

- The strategic issue involves the extent to which manufacturing functions can be restructured in response to current technological trends. Vendors should participate in this issue also.

The conclusions and recommendations just discussed are listed in Exhibit VI-1.

EXHIBIT VI-1

Conclusions and Recommendations

Conclusions

- High level of user interest in client/server use, downsizing and outsourcing
- Need for data in multiple areas promotes client/server use
- Need for responsiveness and improved productivity drives client/server use and downsizing
- Financing pressures related to changes in a complex information technology environment promote consideration of outsourcing
- Client/server and downsizing aid offers an opportunity to many information services vendors

Recommendations

- User efforts to find means of improving performance through client/server use and downsizing should be supported
- Planning to support the data management and interconnection needs of user functions should be initiated
- User initiatives and growing interconnection with suppliers and users should be factored into planning to integrate and reshape manufacturing functions

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A

Definitions

No industry-specific definitions have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for general definitions of industry structure and delivery modes used throughout INPUT reports.

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B

Forecast Data Base

Exhibit B-1 presents the forecast data base for the discrete manufacturing sector.

EXHIBIT B-1

Discrete Manufacturing Sector
User Expenditure Forecast by Delivery Mode, 1991-1997

Delivery Modes	1991 ($ M)	Growth 90-91 (%)	1992 ($ M)	1993 ($ M)	1994 ($ M)	1995 ($ M)	1996 ($ M)	1997 ($ M)	CAGR 92-97 (%)
Sector Total	11,858	10	13,100	14,593	16,263	18,173	20,414	22,928	12
Processing Services									
- Transaction Processing	838	4	875	915	956	994	1,038	1,077	4
Turnkey Systems	2,798	11	3,097	3,404	3,727	4,084	4,509	4,975	10
Applications Software Products	1,967	13	2,224	2,530	2,881	3,295	3,799	4,380	14
- Mainframe	383	7	410	442	467	492	524	557	6
- Minicomputer	1,046	11	1,158	1,260	1,389	1,522	1,685	1,865	10
- Workstation/PC	538	22	656	820	1,025	1,281	1,590	1,958	24
Systems Operations	574	18	688	235	1,000	1,200	1,420	1,680	20
Systems Integration	1,136	19	1,346	1,620	1,953	2,355	2,915	3,536	21
Professional Services	4,459	7	4,766	5,163	5,593	6,059	6,505	7,000	8
Network Services	86	21	104	126	153	186	228	280	22
- Electronic Info. Svcs.	43	19	51	61	73	87	105	127	20
- Network Applications	43	23	53	65	80	99	123	153	24

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EXHIBIT B-2

Discrete Manufacturing Sector
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 rpt (%)	91-96 CAGR per data 92 rpt (%)
	1991 Report (Fcst) ($ M)	1992 Report (Actual) ($ M)	Variance from 1991 Report ($ M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($ M)	1992 Report (Fcst) ($ M)	Variance from 1991 Report ($ M)	Variance from 1991 Report (%)		
Total Discrete Manufacturing Sector	11,858	11,858	0	0	20,967	20,414	-553	-3	12	12
Processing Services	838	838	0	0	1,038	1,038	0	0	4	4
Turnkey Systems	2,798	2,798	0	0	4,715	4,509	-206	-4	11	10
Applications Software Products	1,967	1,967	0	0	3,799	3,799	0	0	14	14
Systems Operations	574	574	0	0	1,400	1,420	+20	+1	20	20
Systems Integration	1,136	1,136	0	0	3,042	2,915	-127	-4	22	21
Professional Services	4,459	4,459	0	0	6,705	6,505	-200	-3	0	8
Network Services	86	86	0	0	268	228	-40	-2	26	22

The actual 1991 market is identical with the estimated market, because the estimation was made near the end of 1991.

Estimates of the 1996 market for SI, professional services, turnkey and network services have been reduced by 4% or less. Turnkey services will be separated into software products and workstations, reducing turnkey revenues.

The projection of continuing economic problems has led to decreases in projections for SI, professional services, and network services. Although the CAGR has not changed, a slight increase has been made for the projection of SO to account for the cost savings appeal of SO alternatives.

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About INPUT

INPUT provides planning information, analysis, and recommendations for the information technology industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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U.S. INFORMATION SERVICES
MARKET ANALYSIS PROGRAM

Process Manufacturing

Information Services Opportunities & Trends

1992-1997

INPUT®

1280 Villa Street, Mountain View, CA 94041, (415) 961-3300

JULY 1992

PROCESS MANUFACTURING

INFORMATION SERVICES OPPORTUNITIES AND TRENDS

1992-1997

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Information Services Opportunities and Trends, 1992-1997

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MAAPM • 611 • 1992

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I

Introduction

A

Purpose and Methodology

1. Purpose

There are five basic objectives of this U. S. Information Services Market Analysis Program (MAMAP) vertical market report:

- Introduce the reader to the process manufacturing industry's structure and demographics
- Identify the business issues and trends that are driving the use of information services within the process manufacturing industry
- Discuss how the process manufacturing industry uses information systems organizations
- Discuss the information services market within the process manufacturing industry, including market sizing and the factors driving market demand for each delivery mode
- Discuss the competitive environment and profile leading information services vendors in the process manufacturing industry

2. Methodology

Much of the data upon which this report is based were gathered during 1992 as part of INPUT's ongoing market analysis program. Trends, market size and growth rates are based primarily upon in-depth interviews with users within the process manufacturing industry. INPUT maintains ongoing relationships within the process manufacturing industry and the IS vendors serving the process manufacturing industry and also maintains ongoing relationships with, and a data base of, all users and vendors that it interviews. Interviewees for the research portion of this report were selected from this data base of contacts.

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In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include several on-line periodical data bases, subscriptions to over 50 computer and general business periodicals, continually updated files on over 3,000 information service vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that vendors may be unwilling to provide detailed breakouts by delivery mode or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different delivery modes from those used by INPUT. Thus, INPUT must estimate revenues by these categories on a best-effort basis. The delivery mode and individual segment forecasts should be viewed as indicators of general patterns and trends rather than as specific, detailed estimates for individual years.

When the information is provided from vendors as requested, at times it is provided under an agreement of confidentiality. Therefore, vendor rankings based on these revenue figures should be considered indicative rather than definitive, and the revenues themselves should be viewed as approximations only.

B
Industry Structure

INPUT divides the manufacturing information services market into two broad subsectors: discrete and process manufacturing applications.

Discrete production involves the manufacture of products created from discrete parts/units. Some of the parts/units are tooled/produced internally, and others are obtained from outside sources.

Process manufacturing refers to the conversion of natural resources into usable products. There are three ways that this conversion process can occur: batch, continuous-flow processing, and extraction. Batch manufacturing usually involves the processing, in large batches, of formula-based substances, as used in processing food, petrochemicals, pharmaceuticals, and biochemicals. Continuous-flow processing generally refers to processing of materials flowing through a pipe (petroleum) or the processing of sheet-type products such as paper, rubber, aluminum, and plastic on continuous-flow, roller-based equipment. The extraction process refers to particular mining operations.

Exhibit I-1 provides a listing of the various SIC groups included in process manufacturing.

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EXHIBIT I-1

Process Manufacturing Subsectors

SIC Group	Description
20xx	Food and kitchen products
24xx	Lumber and wood
28xx	Chemicals and related products including paints, pharmaceuticals and perfume
29xx	Petroleum and related industries
30xx	Rubber/miscellaneous products
32xx	Stone, clay, glass and concrete products
35xx	Industrial and commercial machinery and computer equipment
33xx	Primary metal industries

Process manufacturers represent about 40% of all manufacturing firms worldwide and nearly half of the Fortune 500 are part of the processing manufacturing industry. About 148,000 companies are considered process manufacturers. These companies tend to be highly decentralized, with multiple plant operations.

C
Organization and Contents of Report

The remainder of this report is organized as follows:

- Chapter II—Trends, Events and Issues—provides background information on the business issues and trends that are driving the use of information services within the process manufacturing industry. Forces of a general nature, such as the impact of the U.S. and world economies, and

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process manufacturing industry-specific forces, such as changes in the regulatory and production environment, are discussed. The section on issues discusses the likely impact of the changes in the structure of key segments of the industry.

- Chapter III—Information Systems Environment—provides an overview of the information systems technology and applications that are used to support business processes in this industry. Data on budgeting issues in the current information systems environment of the process manufacturing industry is presented.

- Chapter IV—Information Services Market—discusses the forecast of information systems expenditures by the process manufacturing industry. Information is provided for each delivery mode included in INPUT's MAP reports.

- Chapter V—Competitive Environment—identifies leading IS vendors in the industry, discusses some of the factors that affect the competitive dynamics of the industry, and profiles representative vendors.

- Chapter VI—Conclusions and Recommendations—reviews the trends and opportunities described in the report and provides recommendations for vendors as well as users.

In addition, there are two appendixes:

- Appendix A presents industry-specific definitions that are used throughout the report.

- Appendix B presents the forecast data base and the forecast reconciliation. The forecast data base contains a yearly (1991-1997) forecast of user expenditures by delivery mode for the process manufacturing industry. The forecast reconciliation compares this report's forecast with the forecast provided in INPUT's previous process manufacturing report and explains the reasons for any major differences.

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II

Trends, Events and Issues

This chapter discusses trends, events, and issues in the process manufacturing industry. Section A, Trends and Events, highlights overall business and social forces as well as industry-specific trends that are critical in process manufacturing today

Section B, Issues, identifies factors specific to the various subsectors in process manufacturing that are driving the demand for information services. As noted in Chapter I, process manufacturing represents a broad array of industries with distinct characteristics. Many of the business issues and events that affect them most are unique to their own business segments. Technology needs based on these trends/issues are also discussed.

A
Trends and Events

1. General Business Trends

Four major business trends, having a major impact on process manufacturing companies today, are shown in Exhibit II-1.

EXHIBIT II-1

General Business Trends Affecting Process Manufacturers

- U.S. recession
- Global competition
- Regulatory changes
- Quality

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The impact of each of these trends on process manufacturing companies is discussed below.

Recession—The economic downturn in the United States has had a significant effect on process manufacturers; some subsectors were particularly hard hit. Companies in the commodity chemicals and petroleum industries have been operating at a survival level in recent years. *Chemical Week* magazine recently reported that the top 50 chemical producers stagnated last year. Chemical companies, like many discrete manufacturing companies, are dependent upon the automobile industry for their continued operation and growth, and have been affected by the downturn in that industry.

Although a return to better times is expected, four of the oil industry giants—Exxon, Mobil, Tenneco and Occidental—reported significantly reduced earnings in the first quarter of 1992, as shown in Exhibit II-2.

EXHIBIT II-2

Major Oil Companies Reduced Earnings in First Quarter 1992

Company	Percent Decrease
Exxon	-39.7
Mobil	-82.0
Tenneco	-51.8
Occidental	-27.9

Pharmaceuticals and food/beverage companies are somewhat more "recession proof" because they make purchases that are less discretionary in nature. People need to eat and have medicine regardless of economic conditions. However, the food industry has experienced a change in buying patterns, with consumers going "back to basics" and reducing purchases of some of the higher margin specialty products.
Some specialized industries such as cosmetics have remained strong despite the recession, with companies in that sector enjoying growth in recent years.

The Department of Commerce (DOC) predicts a turnaround in the economy in the last part of 1992, with a real increase in the gross national product (GNP) of 3.25% per year between 1992 and 1996, beginning with 3% in 1992. Two key industries expected to contribute to growth in 1992 are manufacturing and services. Exhibit II-3 shows growth trends.

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EXHIBIT II-3

Growth Rates of Selected Industries 1989-1992

Industry	1989	1990	1991	1992
Food/Beverage	-1.6	2.0	0.8	1.5
Wood	-2.7	-3.4	-4.3	2.3
Paper/Allied	1.1	1.6	0.7	2.2
Chemicals/Allied	1.3	2.8	0.6	1.4
Plastic/Rubber	1.7	-2.0	-2.4	3.0

Source: U.S. Industrial Outlook

The DOC predicts that 1992 with be the first year since 1988 that there will actually be growth in shipments of manufactured goods, as shown in Exhibit II-4.

EXHIBIT II-4

Average Shipment Growth in Manufacturing 1989-1992

	1989	1990	1991	1992
Median	-5.0	-1.0	-1.9	2.0
Mean	-2.0	-0.1	-1.9	2.6

Source: U.S. Industrial Outlook

Among process manufacturers, pharmaceuticals is expected to enjoy the fastest rate of growth; chemicals/petroleum are expected to be among those growing the slowest. These industries tend to be cyclical; key growth years were in 1974, 1981 and 1988. Modest levels of growth are expected in 1994-1995 with a return to peak growth in 1996-1997. Exhibit II-5 lists some of the major process manufacturing subsectors and their expected growth of shipments.

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EXHIBIT II-5

Growth in Selected Process Manufacturing Subsectors

Industry	Size ($ Billions)	1992 Growth (Percent)
Pharmaceuticals	59	9.0
Metals	59	4.0
Cleaning Preparations/ Cosmetics	42	3.7
Plastics/Rubber	33	3.0
Inorganic Chemicals	22	3.0
Wood	12	3.0
Industrial Chemicals	66	2.9
Crude Petroleum, Gas	77	2.0
Food and Beverage	361	1.4
Chemicals/Allied	292	1.4
Petroleum Refining	136	1.0

Source: U.S. Industrial Outlook

Some of the process manufacturing subsectors, such as certain types of chemicals and petroleum, are commodity businesses competing on price. Others, such as cosmetics and various food categories, can expand their businesses by offering an increasing array of specialty items. In general, process manufacturers tend to be in mature industries that anticipate only modest rates of growth in the coming years.

Global Competition—The DOC forecast discussed above cites foreign trade as a key factor in achieving economic growth. Clearly, American business increasingly is operating in a global marketplace. In INPUT's 1990-1995 report, it was noted that many of the industries classified under process manufacturing had escaped intense foreign competition. Today, process manufacturers are finding that to stay competitive they have no choice but to operate on a global scale. This applies not only to sales, but also to the acquisition of raw materials and the production of products. As an example, the petroleum industry has always been at the mercy of the fluctuating world oil supply and its dependence on the state of world politics. However, in talking to process manufacturing executives in

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industries such as food/beverage, steel and chemicals, global competition was cited among today's top business concerns. Because their customers are doing worldwide sourcing, the executives reported that they must be competitive internationally. Also, as many of the industries are mature and offer commodity items, they are reliant on foreign trade to grow. In addition, the high cost of manufacturing in the U. S. continues to drive companies to place plants outside of the United States.

Global competition affects IS in a number of areas. It drives demand for international telecommunications. It makes maintaining product consistency more challenging and makes tracking manufacturing data and integrating that information into business systems more important. Although opening up world markets creates more opportunities for growth, it also complicates the logistics process, leading to the need for systems to support worldwide sourcing and distribution. Demand for EDI for communication between suppliers and customers will continue to be an enabling technology supporting global competition.

Regulatory Issues—Almost all of the segments in process manufacturing are heavily impacted by regulatory requirements. A variety of regulatory issues are involved, as shown in Exhibit II-6.

EXHIBIT II-6

Regulatory Constraints

Industry	Regulation
Chemical/Petroleum/Paper	EPA/Green Movement
Food/Beverage	FDA/NLEA 1990
Pharmaceutical	FDA/Electronic Filing

These industries are particularly affected by environmental regulations and the green movement. New regulatory requirements are constantly being introduced and modified. In the chemical industry, regulations support "right to know" requirements that provide information to the public. Material Safety Data Sheets (MSDSs) are required to provide information on every product for hazardous materials tracking. Companies face hefty fines if they are found to be out of compliance, so regulatory issues become a critical part of running these businesses. Much of the regulation relates to process safety measures that describe how to manufacture, how to train staff, and other safety-oriented concerns.

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For the food industry, different regulatory requirements and agencies are involved. A recent requirement of significant impact to this industry is the Food Labeling Law, introduced by the FDA and referred to as the Nutrition Labeling and Education Act (NLEA). Compliance with this regulation—which must occur by May 8, 1993—is expected to cost the food industry $250 million to $350 million. There is concern that an overload on the FDA review process will result in a slowdown in getting products reviewed and a consequent delay in getting new products to market.

Many process manufacturers and IS vendors cited ISO 9000 as a key regulatory issue that will impact their ability to compete internationally. ISO 9000 will require companies that want to do business in Europe to obtain vendor certification. This will require detailed documentation of internal business processes. European customers will establish partnering arrangements and do business only with certified vendors.

Clearly, regulation can be a barrier to both global and domestic competition . This applies not only to the restrictions placed on companies by regulations, but also to the documentation required by government entities to provide proof of compliance. Advances in IS technology at the PC/workstation level have allowed chemical companies to track waste and maintain MSDS documentation. Electronic filing in the pharmaceutical industry will require companies to provide needed information on-line. The intent of this is to speed the approval process, allowing new drugs to be available for public consumption sooner. In the food industry, labeling software allows companies to rough out ingredients in new products and track changes, thereby reducing the need for chemical analysis. Streamlining the paperwork associated with regulation will allow companies to be more competitive and speed up the process of introducing new products.

Quality—Process manufacturers, like their counterparts in the discrete manufacturing industries, are putting increasing emphasis on quality and quality programs. The very nature of process manufacturing makes quality more complex to measure than in discrete industries. In products like paint, chemicals and food, it is not possible to tell by physically inspecting the product whether it conforms to the formula or recipe. As one industry representative noted, "You can judge quality in manufacturing a toaster by testing to see if it works or not—with chemicals and food it's not that simple."

Quality often means consistency in process manufacturing. Consistency can be difficult to monitor or maintain. For example, in the petroleum industry, what is produced is determined by what was in the crude oil. Things such as moisture can affect the quality of what is ultimately produced. Process manufacturers need a means of tracking a product to determine whether it conforms to the formula/recipe desired or if it more closely conforms to another product. This becomes complicated as by-products are produced and the product changes its characteristics during processing.

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Plant management systems become important tools in tracking production information and maintaining consistency and quality. These systems look at plant operations, scheduling and planning, and provide optimization tools. Interfaces to MRPII systems allow companies to optimize not only the plant operations, but other important parts of the operation such as inventory control, sales/marketing and distribution.

2. Industry-Specific Trends

Although the products manufactured by the various subsectors of the process manufacturing industry vary widely, there are several common trends affecting the industry as a whole, as shown in Exhibit II-7.

EXHIBIT II-7

Industry-Specific Trends

Trend	Description
Logistics	Managing the supply chain
Productivity/Efficiency	Optimizing manufacturing process
Customer Service	Responsiveness to customer needs
Pricing	Cost/activity-based pricing

Logistics—To meet customer demand and maximize both efficiency and productivity, it is necessary for process manufacturers to carefully orchestrate the logistics process or "manage the supply chain" as shown in Exhibit II-8.

Managing the activities related to material, deliveries, containers used and transportation equipment is an essential part of the operation of process manufacturers. This includes in-bound materials management addressing which vendors will supply various plants with materials, where and how inventory will be delivered, stored and replenished, and how overflow will be managed. Inventory management alone is a critical applications area for process manufacturing that can have a major impact on competitive advantage if efficiency and waste can be minimized while maintaining consistency. Managing peaks and flows of customer demand, based on promotions, adds to the complexities involved. Out-bound materials management deals with how and where the products will be delivered.

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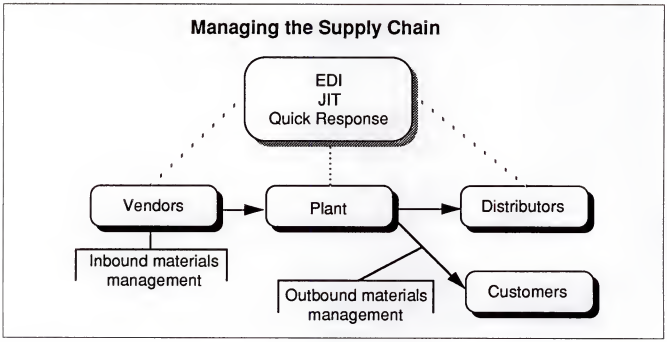
EXHIBIT II-8



Current trends have made these processes challenging. Manufacturers want to minimize inventory costs and yet assure that raw materials are available or can be obtained quickly when needed. Their customers have ever-increasing demands that specify how products should be packaged and shipped. The process for ordering and invoicing is an integral part of the operation.

Process manufacturers are finding that it is beneficial to limit the number of suppliers they deal with and form partnerships with them to determine the most efficient process. In some cases, this involves locating vendor distribution centers adjacent to plant locations and bringing a pipeline directly into the plant. For instance, just-in-time manufacturing practices reduce inventory costs; EDI can facilitate and reduce the time involved in order processing.

Productivity/Efficiency —Although labor and material are major costs associated with discrete production, in the process industries most of the costs are related to equipment operations. Therefore, productivity in this environment is closely related to optimizing equipment operations. For example, in producing paper, a customer may require various levels of quality relating to paper thickness. If the paper is too thin, it can tear, requiring workers to take time out from the production process to set up again, which is costly. On the other hand, if the paper is made too thick (to minimize tearing) it is also costly, because the customer will be getting a higher grade of paper for the cost of a lower grade.

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The materials used can change their properties during manufacturing, so it becomes important to constantly monitor the process. With the current emphasis on recycling, there is also a need to monitor the use of recyclables and be concerned with waste management.

Customer Service—Much of the customer service effort in process manufacturing industries is focused on being able to react quickly to customer needs for various products. Once again, this is not so simple in the process industries. For example, a customer may have an immediate need for a "make to order" chemical. Although this may take some time to produce, the company may be able to respond right away if it has the appropriate inventory. Given the various properties of chemicals, information systems (IS) inventory systems are needed to determine whether the need can be met quickly with current inventory. IS technology that can support quick response and JIT manufacturing will grow in importance as customers expect to obtain products quickly in support of their own JIT programs. EDI is a technology that enables this.

Pricing —Given the high cost of overhead in this industry, it has been difficult for companies to relate costs to specific products and therefore base prices on the cost of production. Many process companies can't easily identify the profitability (or lack thereof) of various products. As these companies feel increased global competitive pressure and face the fact that some products are becoming commodities, the importance of cost-based pricing will increase. MRPII-type systems interfaced with plant-level systems provide solutions to these issues. Executive information systems can also make use of relational data bases to perform detailed analyses of these issues.

B
Issues

1. Business Issues

Competition in commodity subsectors such as food, certain chemicals, and beverages has led to these industries' focusing on being low-cost producers. In addition, many process manufacturers have been concentrating on developing new specialized products to differentiate themselves and also to gain higher profit margins. Industries such as consumer packaged goods, chemicals and petroleum are trying to find ways to develop niche segments. Items like bleach, that were once considered "all the same," are now differentiated by a variety of packaging options developed for customer convenience (e.g., individual packets, squirt bottles). Manufacturers that are first to develop a new product or new packaging concept clearly have an advantage.

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There is strong competitive pressure to get new products to market quickly. There are 120,000 products competing for grocery store space. Providers of new products must become dominant quickly to gain the competitive edge for the coveted shelf space. In pharmaceuticals, being the first to market with a new drug is critical to market positioning.

In the different subsectors of process manufacturing, some aspects of the business are more important and generally more costly to companies than other areas, as shown in Exhibit II-9.

EXHIBIT II-9

Key Business Areas

Industry	Key Business Area
Food/Beverage	Logistics
Chemicals	Manufacturing process
Pharmaceutical	R & D

For example, in the food industry, logistics is a particularly complex area. Managing the distribution network is complex, as various goods are delivered through different means of distribution (truck, rail) to a broad network of sites. In chemicals, the primary area of concern is the manufacturing process itself and the complexity of maintaining quality and consistency. In pharmaceutical companies, R&D is by far the most important part of the business. Companies will be most likely to invest their IS dollars first on the part of the business operation that is most important to their success.

2. Technology Issues

Integration—It seemed that in the 1980s, emphasis was on investing in the shop floor and automating some of the processes. It has been predicted that the 1990s, on the other hand, will be the decade of integrating the enterprise. There is much concern about integrating the shop floor with the rest of the business. Many companies have sophisticated real-time systems on the shop floor, yet the data is fed into batch systems on the business side. As these companies consolidate their operations and focus on optimizing plant operations, logistics and business functions, integration of systems through development of standards, use of relational data bases and moving toward open systems will become increasingly important, as seen in Exhibit II-10.

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EXHIBIT II-10

Key Technology Trends

- Integration
- Consolidation
- Downsizing
- Interoperability
- Software customization tools
- Graphical user interface

Consolidation—In the aftermath of the many mergers and acquisitions that have taken place in these industries, many of the large process manufacturers are now trying to consolidate their operations with IS. As this consolidation process takes place, companies are rethinking their strategic systems plans, looking at changes in architectural strategies, and implementing changes to new hardware platforms. Standardization is a major part of this restructuring.

Downsizing—Companies in these industries are looking at downsizing with strong interest. New investments are increasingly being made at the LAN and PC/workstation level. Several companies indicated that for a new application, they will always evaluate whether it can be done on the PC/LAN level first, before developing it on a mainframe or minicomputer. Although many companies seem to believe that client/server technology is important, it is unclear how much and how quickly companies in this industry will move to this technology. Most speak of being interested in client/server but few have definite plans for implementation.

Interoperability—The ability to link various platforms is very important to process manufacturers. Open systems and UNIX are standards that will become increasingly important. However, currently process manufacturers are primarily concerned with selecting solutions that will be compatible with those that they may obtain in upcoming years.

Software customization tools—Process manufacturers have focused most of their development efforts internally. As they move toward using packaged software and integrated systems, CASE tools and 4GLs will continue to be of importance to this industry.

Graphical user interface—Process manufacturers have a strong interest in this technology. GUI will be very important for optimizing efficient use by production staff and management in advancing their use of process control, supervisory and plant management systems.

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III

Information Systems Environment

Process manufacturers have traditionally been IBM mainframe-based shops. They have typically considered their systems requirements unique and therefore have maintained large in-house development staffs to address needs. Their use of outside services has been low compared to other industries. Investments that have been made for outside services have been primarily for custom software development. Process manufacturers have made limited use of off-the-shelf software because, until recently, few vendors had products designed to specifically meet the needs of process manufacturing.

Until relatively recently, the software available to process manufacturers were modifications of products designed for discrete manufacturers. As seen in Chapter V of this document, the availability of process manufacturing software has increased significantly in the past two years.

Some of the largest process manufacturers are sophisticated users of information technology. For example, Merck was designated one of the top-ranking users of IS by *Datamation* because of its use of IS to speed new medicines to market. However, many of the companies in subsectors such as food processing and steel indicated that they considered their industries to be comparatively slow in strategic use of information systems.

A
Applications

Information services applications for process manufacturing can be linked under certain general functional applications, as shown in Exhibit III-1:

- Shop Floor/Information Management
- Corporate/Business Planning and Control

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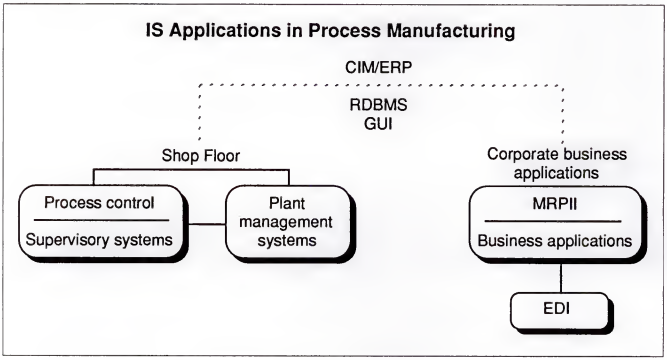
EXHIBIT III-1



Shop floor monitoring/control in process manufacturing can involve several layers of automation, with plant floor information management systems representing the highest level of function. The various functional layers of control/monitoring in process manufacturing are now based on distributed, digital process control systems that can provide integrated control capability both vertically and horizontally, from the instrument/sensor level to plantwide control and information management systems. There is a trend toward both distributed processing and decentralized management on the plant floor, along with the increased use of mini- and micro-based platforms for integrated business and plant information systems. Distributed relational data base management systems (RDBMSs) have also been an enabling technology along with on-line transaction processing (OLTP) solutions and fault-tolerant capabilities—all of which maximize the timeliness of data/information distribution. The manufacturing process itself, in this industry, is more highly automated than that in discrete manufacturing. Process manufacturers use fewer people on the shop floor and make use of process control systems for the manufacturing process. These process-level systems have generally been designed by engineering staffs with little input from IS. In fact, IS and the plant floor have tended to be two very different domains.

IS has become involved in the relatively new area of plant management systems, as shown in Exhibit III-2.

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EXHIBIT III-2

Plant Management Systems

- Real-time data collection from shop floor
- Planning and scheduling
- Tracking/monitoring and control
- Quality management
- CIM interface

These products integrate data acquisition software for real-time data collection with statistical analysis tools. They are used to implement dynamic scheduling and other capabilities to optimize factory management operations. For example, in a petrochemical plant, hundreds of controllers are used to regulate various processes. Plant management systems can take PLCs and supervisory control systems and feed the business systems. These may be integrated with both current (real-time) data from distributed process control systems and historical data base information from plant floor control and business planning applications. They affect plant floor operating efficiency by adjusting plant operations based on interactive information exchange among the plant floor process control systems, and plant floor management and business planning and process engineering organizations. Plant management systems are considered one of the fastest growing segments of software for process manufacturing. IBM's POMS and Ross Systems' Promix are examples of the types of systems that have been specifically designed for the process manufacturing industry, as shown in Exhibit III-3.

EXHIBIT III-3

Selected Process Manufacturing Vendors

Process Level	Plant Management	MRPII
Allen-Bradley	IBM POMS	Datalogix GEMMS
Honeywell	Ross Promix	Marcam Prism
		ASK MANMAN

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Corporate/business planning and control systems include human resources, financial fixed-asset systems, warehouse distribution and other financial accounting packages. These functions—along with others such as order management and material requirements planning/scheduling—are provided by vendors on an integrated or modular basis as part of manufacturing resource planning systems (MRPII), as shown in Exhibit III-4.

EXHIBIT III-4

MRPII Systems
Major Functions

- Production management
- Logistics
- Sales order processing
- Product cost
- Regulatory compliance
- Inventory management
- Financial functions

MRPII systems offered to process manufacturers were, until recently, modifications of systems that were originally developed for the discrete manufacturing industries. These systems ignored key issues of concern within the process industries, such as capacity constraints, lot-to-lot variability and formula management. Vendors such as Datalogix and Marcam have addressed this problem by developing MRPII systems focused specifically on process manufacturing.

A technical barrier within process manufacturing companies has been the schism between the real-time/transaction processing systems on the plant floor and the batch-type solutions in many of the corporate headquarters' planning and management systems. Computer-integrated manufacturing (CIM) has been considered the solution to providing such integration in the past. However, CIM is a buzzword in the industry that has taken on different meanings to different people. Some consider CIM to be limited to the manufacturing environment itself, while others consider it the means of linking the whole enterprise. Other terms currently used to describe the integration of systems are *enterprise resource planning* systems (ERP) or *enterprise integration*, as shown in Exhibit III-5.

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EXHIBIT III-5

CIM/ERP Systems

MRP shares data with corporate systems/plant

Uses RDBMS

Features GUI

Some view ERP as simply the new generation of MRPII systems with the capability of integrating systems such as logistics, marketing, sales and financials. Others view it as the solution to integrating the enterprise. Regardless of what they are called, systems to integrate the enterprise are built around a central, integrated relational data base, which also provides tools for end-user data access. Many of the vendors of plant management systems and MRPII systems are adapting their products and positioning them as ERP/CIM solutions to meet the needs of enterprisewide computing within the process manufacturing industry.

The need to integrate the enterprise represents a significant market opportunity for systems integrators, as well as for other types of process manufacturing products vendors, to provide more efficient two-way data/information exchanges between the transaction-based (interactive) plant floor information management systems and the corporate-level MRPII and accounting systems. Professional services/systems integration and computer systems companies such as Andersen Consulting, Computer Task Group, Ernst and Young, EDS and IBM have been increasingly active in providing consulting and implementing integrated (CIM- or ERP-type) solutions to process manufacturers. Much of their application development activity involves the implementation of customized solutions through use of CASE and other types of application development tools. Only 14% of process manufacturing companies currently make use of packaged software for their manufacturing solutions, as seen in Exhibit III-6.

Process manufacturing is characterized by large numbers of plants compared to discrete manufacturing. Yet the plants must be managed on an enterprise basis. This also presents a challenge to integrating the enterprise.

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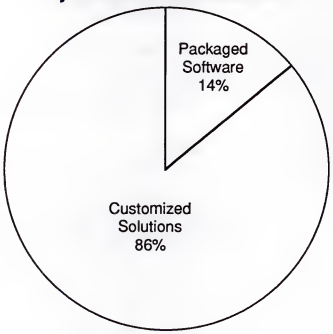
EXHIBIT III-6



B

IS Technologies in Process Manufacturing

In looking at the needs of the process manufacturing industry, EDI is clearly an important technology and will continue to be so as companies in this industry compete on a more global scale. Other technologies that are expected to grow in importance for process manufacturers are listed in Exhibit III-7.

EXHIBIT III-7

IS Technologies of Growing Importance to Process Manufacturing

- EDI
- Open systems
- CASE tools/4GLs
- GUI
- AI
- Image processing

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1. EDI

EDI is one area where the process manufacturing industry has made significant advances in recent years. However, progress has not been universal, and some subsectors have exceeded others in implementing EDI. Most notable among sectors making use of this technology are the food, chemical, pharmaceutical, and petroleum industries. These industries typically have many trading partners and are putting increased emphasis on responding quickly to customer orders and minimizing related costs.

Food manufacturing is strongly interlinked, with manufacturers—even competing manufacturers—purchasing supplies and ingredients from each other. Approximately one-third of total output by U.S. food manufacturers is consumed by food manufacturers. Exhibit III-8 shows the basic food manufacturing groups and the trade flows among them.

Note that large food conglomerates own operations in many and even all sectors of the manufacturing groups shown in the exhibit. Vertical integration can be found throughout the industry.

EDI is also having an effect on where companies use suppliers. A Dow spokesperson was quoted in a recent issue of *Chemical Week* as saying the "biggest challenge for 1992 remains working with suppliers to contain costs." Chemical companies are reducing the number of suppliers with whom they do business. They want to partner with suppliers, reduce raw materials inventory and automate purchasing via computers. For chemical companies, the installation of an EDI system is a development expense that can be leveraged/amortized across many trading partner relationships as seen in Exhibit III-9.

The potentially large scale of EDI use by a chemical company ensures that the investment in an EDI system will have a high return, because the use of the EDI system has an increasing return to scale (i.e., per-use cost goes down the more the EDI system is used).

The pharmaceutical industry has been one of the pioneer implementers of EDI, starting with a proprietary format in the 1970s developed by and known as Ordernet. The Ordernet system allows wholesalers and buying groups to send purchase orders to drug manufacturers and to settle price discounts when manufacturers sell directly to hospitals, as shown in Exhibit III-10.

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EXHIBIT III-8

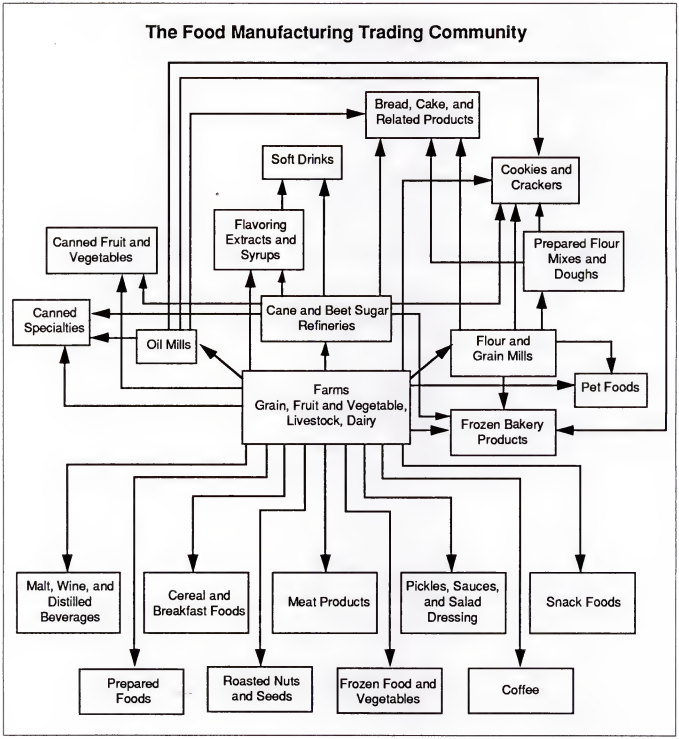

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EXHIBIT III-9

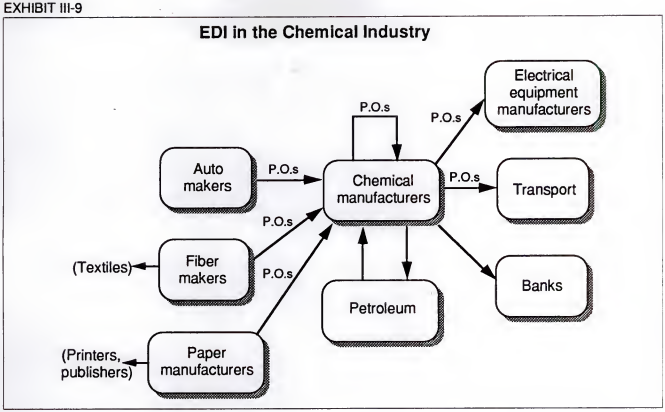
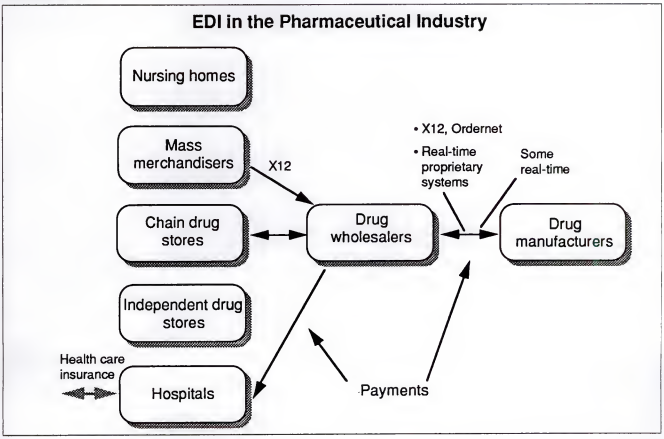


EXHIBIT III-10



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Originally designed to assist drug makers and wholesalers in working out charge-backs, Ordernet developed the Medimetrick data base and, in the process, introduced the EDI "transaction" data base.

Wholesalers agree to let Ordernet aggregate sales information taken from EDI transactions as well as data submitted by other means. The resulting data base reveals sales of specific drugs by region and by wholesaler. The information is used for market research purposes as well as the settling of charge-backs. Often a drug maker negotiates a drug sale directly with a hospital, but instructs a wholesaler to deliver the physical product and collect payment. The wholesaler may have purchased the product from the maker at a cost greater than the price the maker negotiated. In this instance, the wholesaler is entitled to a charge-back and submits an electronic charge-back form.

U.S. and Canadian petroleum companies are highly integrated. Pipelines literally tie companies together, as seen in drilling operations and properties that are jointly owned and operated. Distribution of refined products to retailers is shared among companies that constantly swap each other's supplies to meet the vagaries of daily demand at the gas pump.

Parallel to the product flows are information flows involving accounting information. Since the mid-1970s, oil company accountants have developed EDI systems for the movement of this data. The systems are collectively called Petrodex, and they are a family of EDI applications that electronically exchange accounting information among companies. GE Information Services is the sole network service provider of Petrodex.

2. Open Systems

Process manufacturers want to be able to select the most appropriate hardware for the various functions of the business but still benefit from software across these platforms. For example, some areas require fault-tolerant systems, while others do not. However, certain applications may be appropriate on each of the systems, making portability between them important.

Process manufacturers are also interested in the multi-tasking capabilities offered through the UNIX environment, though few seem to be strongly committed to UNIX at present. Relational data bases such as those offered by Oracle, Sybase and Gupta were cited by many as important technologies for supporting their development efforts. Open systems and portability across platforms are key considerations to this industry. If manufacturers find an application that meets a particular need in one area, they want to be able to transport the software across platforms.

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3. CASE Tools and 4GLs

CASE tools and fourth-generation languages (4GLs) are being used by in-house development staff and by the systems integrators/outside software developers serving these industries. It is expected that application solutions within process manufacturing will continue to require software customization to accommodate many of the unique requirements within process manufacturing operations. Process manufacturers are expected to continue to handle much of the development in house and will need development tools to shorten applications development time.

4. GUI

Graphical user interface (GUI) technology is of strong interest to process manufacturers. As they advance their use of process control, supervisory and plant management systems, GUI will be very important for efficient use by production staff and management. Process manufacturers are moving toward downsizing and offloading applications to the PC/LAN level. GUI will be a key technology in efficient use of applications at this level.

5. Artificial Intelligence

Artificial intelligence technologies have tended to focus on the process level. Knowledge-based applications (primarily for proprietary use) have been developed for business planning, equipment maintenance, testing (statistical process control), and supervisory process control applications (i.e., process control and production scheduling as well as education and training).

The development of lower cost expert shell programs, based on standard PC/workstation platforms that are programmed in C-language extensions, makes such knowledge-based systems much more practical for the factory application development environment.

A few of the products in this area include expert systems development shell programs, such as Neuron Data's NEXPERT OBJECT that is also used as a basic development tool in Bechtel Corporation's expert systems development program; expert systems-based CASE tools from Aion Corp.; PICON (Process Intelligent Control) real-time expert systems; natural language processing; machine vision systems; text search facilities based on expert systems front ends; and object-oriented and other types of AI programming languages used in scientific/engineering applications (Ontologic Corp.).

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At present, most knowledge-based systems development for the factory environment is for proprietary, in-house solutions. Products for standard commercial applications have not yet been developed. Most knowledge-based systems are used for troubleshooting and maintenance through rule-based diagnostic techniques.

The state of the art in expert systems for the process manufacturing plant floor today are real-time, on-line systems that can utilize dynamically developed knowledge rules and data to detect measurement or process integrity problems that may lead to measurement or process failures. Another major benefit of expert systems is their ability to be "reprogrammed" with changes in plant operating requirements.

6. Image Processing

Compound document management/image processing has the potential to reduce the paper overload, automate the workflow process, and provide an audit trail for important company records. Image processing routes, assigns, files, and releases records, and monitors the flow of images for a document that must be signed off at different levels (document auditing).

A major benefit of products such as the Wang Integrated Image System (WIIS) is in the automation of the workflow process. This involves the electronic distribution (and annotation) of integrated data, text, and image-based documents without having to "walk" the documents from station to station.

The major bottleneck to improvements in corporate productivity today is in white-collar applications. The automation of the work (paper) flow addresses this issue. It is now possible to automate the storage and distribution of entire documents (images), attach various types of other information to the document such as voice-message and data base information, and transmit the document worldwide by fax systems. Documents can also be distributed with electronic mail systems and can be integrated with computer-calendaring and word-processing applications.

Within process manufacturing, the largest opportunities appear to be in regulatory documents, production planning, decision support systems, and procurement.

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C
Driving Forces

Key factors driving IS development within process manufacturing fall into three broad categories: user demand, competitive environment and technological factors.

The IS executives contacted by INPUT indicated that user demand is the most important factor driving applications development. A large cosmetics firm that has experienced sizable growth in recent years reported that the needs of its sales and marketing department to obtain information necessary to sustain growth is the primary driver for new applications in this area.

These companies are operating in an environment in which getting new products to market quickly—for example in pharmaceuticals and food—is absolutely critical to their position in the market. Likewise, in the commodity sectors where competition is focused on price, systems are needed to support competitive positioning. Companies in the commodity sectors need to better understand what it costs to make the product and therefore what price can be charged to assure account profitability. These needs are driving the demand for systems to address such requirements as regulatory compliance, logistics and activity-based pricing.

The power of today's PC- and RISC-based workstations, along with advances in user interfaces such as GUI, are driving many companies in this industry to think seriously about modifying platform strategies and downsizing. The increased availability of software developed specifically for process manufacturers should trigger increasing moves toward packaged software and reductions in in-house development. CASE tools and 4GL make such moves even more likely. UNIX and the move toward open systems is also influencing the decisions that IS executives are making today.

Although the economy has had a negative effect on growth in IS in recent years, most executives indicated that concerns about the economy in 1992 should not have a significant effect on systems decision making.

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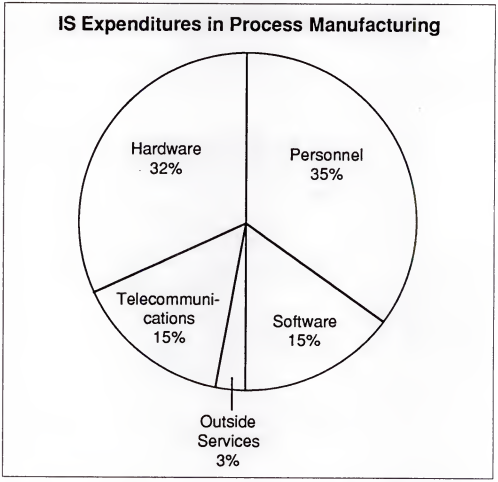
D
Organization and Budget

Expenditures for outside services by process manufacturers are relatively modest, averaging about 3% of the IS budget, as seen in Exhibit III-11.

EXHIBIT III-11



Expenditures in this category are more likely to be for professional/processing services than for applications software or turnkey systems. This is, no doubt, at least partly due to the fact that until recently, there has been limited availability of packaged software for this industry. Also, process manufacturing problems have not lent themselves as readily to turnkey solutions from commercial vendors, and companies have turned to their internal staffs or to outside software developers for solutions to their unique automation problems. As a result, IS budgets in process manufacturing are much more labor intensive than in discrete manufacturing, where budgets are more hardware/software intensive.

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In the subsectors most affected by the recession, notably chemicals and petroleum, IS budgets were reduced in 1991 and have either been cut again in 1992 or stayed steady. In other subsectors, most companies are increasing their IS budgets or maintaining 1991's level of expenditure.

The two-year trend for information systems spending is up for most process manufacturers, apparently reflecting their efforts to use systems improvements to enhance their competitive positions. Integration of systems of all sizes, from PCs to large mainframes, is becoming more and more critical, and the lack of cross-vendor integration and support is a continuing problem.

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IV

Information Services Market

A
Overview

INPUT analyzes the process manufacturing automation market in the context of seven delivery modes. The seven delivery modes include applications software products, processing services, network/electronic information services, turnkey systems, professional services, systems operations, and systems integration.

INPUT estimates that the total process manufacturing information services market in 1991 was approximately $5.5 billion. The market will grow at an estimated 11% annual rate to reach $6.1 billion in 1992. For the five-year period from 1992 to 1997, the total information services market for process manufacturing is projected to grow at an 12% CAGR to reach $10.8 billion, as noted in Exhibit IV-1.

As noted in Chapter I, Department of Commerce projections show that 1992 will be the first year since 1988 that real growth of shipments in manufacturing is expected. In addition, INPUT's interviews with process manufacturing IS executives indicated that IS expenditures are holding steady or, in many cases, moderately increasing. Sectors experiencing significant industry growth, such as cosmetics, have had to rapidly increase their investments in IS to support increased business activities. Those harder hit by the recession have also felt the effects in the IS area, although many of those companies also indicated that the recession has not had a major impact. Many of these companies indicate a need to increase investments to allow them to compete in today's global marketplace.

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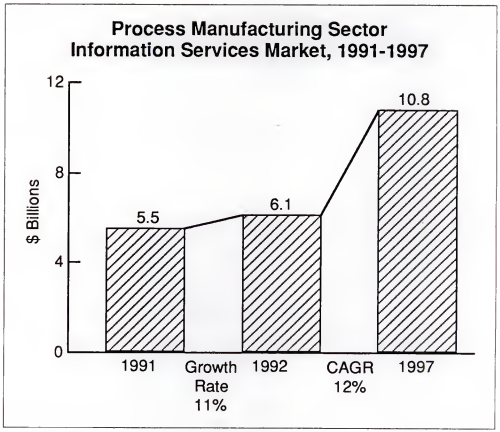
EXHIBIT IV-1



1. Driving Forces

The primary forces driving the demand for information services are directly related to the key business trends and issues discussed in Chapter II. These are discussed below:

Competition on a global scale—As process manufacturers compete internationally, and conduct worldwide sourcing and manufacturing, the complexities of managing information will increase. Systems and software products supporting inventory management, order processing and logistics, and multiple currencies and languages will be required. EDI will continue to be an important technology, and increased competitiveness will continue to drive demand for quick response inventory management capability and activity-based costing, both of which require IS capabilities.

Regulatory requirements—The constantly changing state of regulation can be an inhibitor to effective competitive response and getting products to market quickly. However, it can also be a real driver of technology investments because it requires monitoring and tracking information that, without IS technology, might not even be possible. Requirements such as on-line filing for pharmaceuticals will also demand technology solutions.

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Consolidation/downsizing—As process manufacturers consolidate and migrate applications to different platforms, they begin to rethink current strategies and look for new solutions. This is a time when opportunities exist to provide new solutions to this industry.

Availability of solutions—As vendors continue to develop products and services for specific industry requirements, it will become more cost effective and timely for process manufacturers to implement new software packages and services.

2. Inhibiting Forces

Plant floor/IS dichotomy—Plant floor automation systems have been engineered outside of the IS realm, giving little consideration to how the two areas relate. Now that there is a recognized need for integration, it is often not technically possible or cost effective to do so.

Recession—Companies in several of the subsectors in process manufacturing have had to reduce IS budgets in recent years, with no turnaround in sight. These companies will be focusing on maintaining existing operations and will have to delay satisfying their needs for additional software and/or services.

In-house development—The biggest competitor to vendors is the IS organization itself. Although companies are moving toward use of packaged solutions, most of today's applications development is done on a custom basis. This is an established process that will take some time to change.

3. Analysis

Several important observations can be offered when considering this year's forecast. First, though applications software investments in process manufacturing have been comparatively low, INPUT expects substantial growth in this area due to the increase in software that is now becoming available, which focuses on the unique needs of the process manufacturing industry. Applications software is a new—rather than a replacement—market, as only about 14% of process manufacturing companies actually have such systems in place today.

Networking services will grow at a substantial 17% CAGR between 1992 and 1997. This is attributable to the growing importance of EDI to the process manufacturing industry.

Professional services expenditures continue to play a dominant role in process manufacturing, as (typically) the largest expenditures made by process manufacturers for outside services are for software development. Because in the past process manufacturers have not had access to off-the-shelf software, their approach has been to develop systems internally or

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use outside software developers. In addition, as these companies move to consolidate their operations following the flux of merger and acquisition activity, they turn to outside consultants for assistance in developing strategic plans and architectural strategies. As they move to purchase software, use of professional services to customize systems (using CASE tools) will increase in importance.

B
Delivery Mode Analysis

Exhibit IV-2 presents INPUT's forecast of information systems products and services by delivery mode.

1. Professional Services

The largest process manufacturing information services sector is professional services, estimated to be $2.3 billion in 1992. INPUT estimates that professional services for the process manufacturing market will grow at a 10% CAGR over the next five years.

The major opportunity in process manufacturing information services today is clearly in professional services. However, revenues were not as great in 1991 as they were projected to be by various industry experts. This is due to both the restructuring that has occurred within many professional services firms and the recession, which has made clients more price sensitive. Price cutting has also adversely affected revenues.

The professional services delivery mode will remain the largest mode, and many of the vendors providing professional services to this industry, particularly the larger ones, offer other information services that can stimulate the use of professional services.

Most of the larger professional service vendors in process manufacturing, such as IBM, DEC, and EDS, also provide systems integration services to this industry.

Several software product vendors with offerings to process manufacturing—including ASK, American Software and Oracle—also have professional services business in this industry.

Consulting services is the fastest growing submode of professional services in process manufacturing. Larger professional services and systems integration vendors—including major accounting firms—are profiting from this work.

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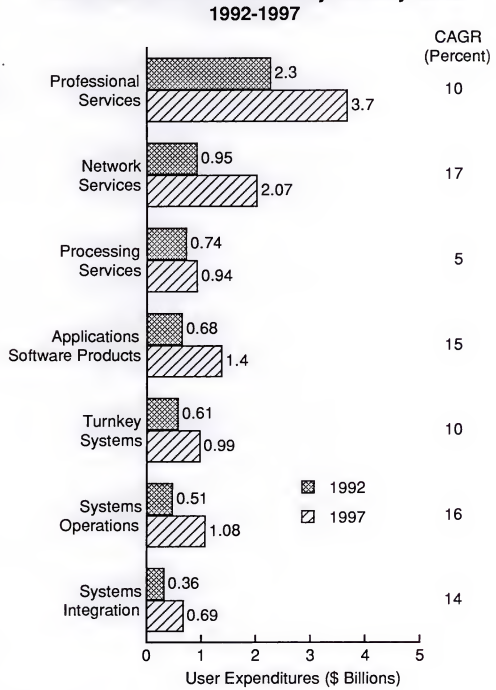
EXHIBIT IV-2



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Booz Allen and McKinsey, firms respected for their consulting abilities, are also performing professional services consulting work for process manufacturing firms.

2. Network Services

The second largest process manufacturing market in 1991, at $813 million, was network/electronic information services. This market is projected to increase at a 17% CAGR. The market consists of data base services, such as those provided by IMS International, Information Resources, and Petroleum Information. EDI is the fastest growing segment within network services. EDI and electronic commerce to support ordering and payment to suppliers (and *from* some customers) are major technologies in this industry. A recent *Datamation* survey indicated that about half of the retail/wholesale companies and their food/beverage suppliers will make use of EDI in 1992. INPUT estimates that EDI and related network applications for the process manufacturing sector will expand at a 22% CAGR over the next five years.

3. Processing Services

The market in 1991 for processing services (including primarily transaction processing services) was approximately $717 million, and is projected to be $939 in 1997. Applications in this area include:

- MRPII processing services offered by leading vendors such as Xerox Computer Services (XCS) and ASK Computer Systems
- Remote processing services provided by Boeing Computer Services to the petroleum industry and a variety of manufacturing sectors
- Specially adapted programs for electronic funds exchange/cash management provided for the manufacturing sector

INPUT projects a five-year CAGR in this subsector of 5%.

The low rate of growth reflects the fact that a number of process manufacturers are selecting workstation/PC solutions rather than mainframe-based processing alternatives for accounting, inventory and other applications.

4. Applications Software Products

Application software products is the fourth-largest process manufacturing industry-specific IS sector today, estimated at $683 million in 1992. The major offerings within process manufacturing applications software are business planning and control applications, and plant management sys-

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tems. Opportunities in applications software include the replacement of older batch systems-based corporate-level MRP applications with distributed on-line transaction-based systems and plant management information systems.

INPUT estimates that the applications software products subsector of the process manufacturing information services market will expand at a 15% CAGR between 1992 and 1997. The workstation/PC segment is expected to show the fastest growth, at 23%.

The favorable growth rate for applications software products and particularly for workstation products is driven by the sale of new offerings for process manufacturing:

- IBM's Process Operations Management System (POMS), which is implemented on the PS/2 and the Datalogix process manufacturing system that runs on the IBM RS/6000 and other equipment, will help drive workstation/PC software product sales.

- The Process/1 system of Andersen Consulting, which uses DEC mini systems, and the Promix system offered by Ross Systems will help drive the use of minicomputer software products. SAP America, Inc. software products will help drive mainframe use.

The increased forecast for the use of applications software products, particularly for workstations/PCs, is also due to increasing industry interest in downsizing, client/server applications and the need for CASE tools, 4GLs and relational data base systems.

5. Turnkey Systems

Turnkey systems are expected to account for $614 million in 1992, and to grow to $990 million in 1997 at a CAGR of 10%. The significant applications in the turnkey systems subsector are MRPII applications delivered in a bundled hardware/software, professional services configuration, and plant management systems. Principal companies in the process manufacturing market for this delivery mode include ASK Computer and Xerox Computer Services.

6. Systems Operations

Systems operations, along with network services, is expected to become one of the fastest growing service modes in process manufacturing.

Outsourcing is a popular IS concept, and INPUT's interviews with process manufacturing companies confirmed that outsourcing is an important issue. However, as a representative from one major outsourcing vendor stated, though many companies are talking about it, not many are actually

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making the decision to outsource now. The number of dollars associated with even one outsourcing contract can be so large, however, that even a small increase in the number of companies turning to outsourcing can have a substantial effect on revenues.

Most of the process manufacturing companies interviewed by INPUT are considering outsourcing, and many had specific ideas regarding which part of the operation would be outsourced. However, not many companies are actually outsourcing currently or have definite plans to do so. Real growth in this area is expected to occur in three or four years.

Major outsourcing vendors such as IBM, EDS and Andersen have targeted process manufacturing as a source for systems operations contracts. The DOC reports that manufacturing in general is one of the top five markets for outsourcing.

7. Systems Integration

Systems integration is a vendor service that provides a complete solution to an information system, networking or automation requirement through the selection and implementation of a variety of information system products and services. Systems integration is expected to account for $360 million in revenues in 1992, and will grow to $686 million by 1997 at a CAGR of 14%. Despite its relatively healthy rate of growth, however, systems integration will continue to be the smallest delivery mode in process manufacturing.

In-house information systems departments and senior corporate management are increasingly looking to professional services/systems integration vendors to provide strategic planning (consulting), implementation strategies, and solutions. However, in the process manufacturing industry, there is a tendency to want to perform these functions in-house. Because of the large size and unique applications of many of the process manufacturers, much of the application development activity is expected to continue to be done in-house.

A major competitive tool for exploiting the potential of this captive market is for a vendor to be able to provide cost-effective customized solutions. This requires strong capability in CASE, 4GL/RDBMS, and expert systems development tools. Professional services/systems integration companies, such as Arthur Andersen and the other major accounting firms, Computer Task Group, and EDS, as well as MRPII companies such as MSA Cincom Systems and Cullinet, have been capitalizing on just such capabilities.

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V

Competitive Environment

A

Significant Information Services Events

In the recent past, a group of products has been announced and sold that is focused on process manufacturing. In addition, a significant number of products and services aimed at *both* discrete and process manufacturing have been sold to process manufacturing firms. Significant alliances, mergers, and acquisitions have occurred between vendors serving the process industry. Events such as these, that characterize the dynamic nature of this vertical market, are included in this section.

Industry-specific products—Products aimed at process manufacturing have been introduced by a number of vendors—including Andersen Consulting, IBM, Ross Systems, Datalogix, and Palette.

- The IBM product, Process Operations Management System (POMS), was first shipped in 1990 and is installed at companies that include Nestle Foods, Campbell Soup, SmithKline Beecham, and Johnson & Johnson. POMS is implemented on the PS/2 and allows users to share information from factory floors with business areas of production.

- The Andersen product—Process/1, which runs on the DEC VAX/VMS platform—provides an interface between process control devices on the plant floor and corporate, enterprise-level business systems. Process/1 handles multiplant, multihost systems and provides environmental health-and-safety features.

- Datalogix's recently announced Global Enterprise Manufacturing Management System (GEMMS) manages process manufacturing functions across multiple hardware platforms and plant locations. The system—which operates on the IBM RS/6000, DEC VAX, and HP computers—is being used at beta test sites by Monsanto, Sun Chemical, and Quaker Oats. The system is a manufacturing resource product designed for process manufacturers with multiple locations.

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- Promix, the process manufacturing system offered by Ross Systems, was obtained through the acquisition of Pioneer Computer in the U.K. Ross Systems noted that there was a need for systems developed specifically for the process industry that would integrate control and process information with business and planning manufacturing functions.

The Datalogix system, discussed above, was installed at Monsanto with the aid of Ernst & Young. Datalogix intends to work with other accounting firms and integrators on the sale and implementation of this product.

Accounting firms have also formed alliances with SAP America, Inc. in order to take advantage of the capabilities of SAP systems for process and discrete manufacturers. A notable installation of SAP software products has been made at ICI, the fourth largest chemical company in the world.

General manufacturing products—New products and services that are aimed at both process and discrete manufacturers include new offerings from Oracle. Oracle's new manufacturing system, which will compete with existing MRP systems, has been tested at four customer sites.

- Oracle will support the product with consulting services and will make arrangements with major accounting firms and other integrators and VARs so that they can represent the product.

- Advantages of the product include its availability on multiple hardware platforms and use of relational data bases, CASE tools, and 4GL and graphics capabilities.

EDS strengthened its general manufacturing capabilities by acquiring McDonnell Douglas SI Co., investing in ASK, and forming alliances with Consilium and Sherpa Corp. EDS plans to build an all-encompassing manufacturing services capability.

In support of its general manufacturing capabilities, IBM introduced the CIM/400 software product that enables users of the AS/400, RS/6000, and PS/2 to share information on design, business, and plant floor systems.

Hewlett-Packard has been releasing software tools that enable data to be exchanged between CAD, MRP, and production applications systems using HP computers and a version of UNIX. HP has plans to interface these tools to a number of computers from other vendors.

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B
Vendor Profiles

A number of different types of information services vendors active in the process manufacturing industry are profiled in this section. Strategies, background information, and the products and services marketed by these vendors are reviewed in order to give a sense of the range of competitive offerings available to the process manufacturing industry.

A number of vendors concentrate on a limited set of capabilities in one or a few functional areas or service modes:

- SAS—which concentrates primarily on cross-industry analytical software products—has developed a pharmaceutical-industry product that will help analyze and present information on new drugs.

- GEIS provides EDI and VAN network applications services to process manufacturers.

Other vendors are more interested in marketing a group of information services products and services that can meet a wide range of customers' and prospects' needs.

- Andersen Consulting, Ernst & Young, and other large accounting firms—as well as other vendors in the information services industry—are attempting to meet a wide range of needs in many areas of process manufacturing.

- Through the acquisition of MDSI and several other vendors, EDS announced that it had strengthened its ability to offer a wide range of services to manufacturing firms.

The larger vendors, such as those mentioned above, serve a number of other markets as well as process manufacturing. There are many small vendors—such as Palette and Factorial Systems—that serve only manufacturing customers.

In addition to the companies profiled, many other information services vendors serve the process manufacturing market, including major manufacturers such as IBM, NCR, and DEC, and large services firms such as GEIS.

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Companies profiled include:

- American Software, Inc.
- Andersen Consulting
- ASK Computer Systems, Inc.
- Dun & Bradstreet Software Services, Inc.
- Marcam
- Ross
- SAP America, Inc.
- Sterling Software, Inc.—EDI Group

Additional information about these companies or other companies active in process manufacturing can be found in INPUT's Vendor Analysis Program.

1. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305, (404) 261-4381

a. Company Strategy

American Software has developed an integrated line of standard applications software products for IBM mainframe and AS/400 platforms. These products run singly or in combination to meet unique customer requirements.

- These products have been supplemented to meet the needs of installations in particular industries, particularly manufacturing.

- American Software will perform professional services work to customize its software products to solve customer problems in process or discrete areas.

In addition to a set of manufacturing modules, American Software can offer a full MRPII system for IBM mainframes and minis.

b. Company Background

American Software was founded in 1970. The company grew to around 800 full-time employees in 1991, and its revenues for 1991 reached $101.9 million. The company provides applications software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation, and government clients.

About 46% of American Software's fiscal 1991 revenue was derived from applications software product license fees; 14% was derived from software maintenance; and 40% was derived from education and training, consulting and programming professional services.

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c. Products and Services

American Software is one of the most successful software products vendors in marketing professional services.

The applications software products that are sold can be divided into two groups:

- Forecasting and inventory management software
- Purchasing, materials control, and financial software

Specific manufacturing modules include master scheduling, materials requirement planning, bill of materials, capacity planning, production work status, shop floor control, and cost management and tracking.

2. Andersen Consulting, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602, (312) 580-0069

a. Company Strategy

Andersen utilizes its reputation in manufacturing and its demonstrations of working solutions to manufacturing and distribution problems as a means of appealing to, and closing business with, prospects that are solution oriented. Andersen focuses more attention on manufacturing than on other markets, but has extended its capabilities to retail and wholesale distribution, banking, utilities, and other markets.

In process manufacturing, Andersen has introduced a unique system that will link plant floor and business functions and provide new types of capabilities in the environmental area. Andersen will use this system, Process/1, as a means of introducing additional products aimed at the business/production management area.

Andersen emphasizes its knowledge of industries and applications, particularly in manufacturing and distribution, to make presentations and conduct consulting studies that can lead to large SI and professional services contracts. By means of studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings at companies that it contacts. The firm uses acquisitions and alliances to gain additional resources and knowledge to address its areas of interest. In 1991, Andersen Consulting entered into an alliance with Microsoft to provide services to develop client/server applications.

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b. Company Background

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its rapidly growing and large volume of information services business. It now has 151 offices in 46 countries employing 21,000 consultants. Estimated worldwide revenues in 1991 for Andersen Consulting were $2.26 billion.

c. Key Products and Services

About 65% of 1991 revenues were derived from systems integration, and 30% from professional services. Additional revenues were obtained from systems operations, applications and systems software products and network services.

Areas of manufacturing expertise include CIM, CAD/CAM, MRPII, robotics, material handling, numerical control, bar code data collection, and change management control.

Andersen offers a computer-aided software engineering toolset called Foundation.

3. ASK Computer Systems, Inc. 2240 W. El Camino Real, P.O. Box 7640, Mountain View, CA 94039-7640, (415) 969-4442

a. Company Strategy

ASK was devoted completely to the manufacturing industry prior to its acquisition of Ingres, and still maintains more focus on manufacturing than do most competitors. ASK offers turnkey systems and software products for HP, IBM, and DEC midrange computers—as well as a processing service—that provide integrated manufacturing capabilities for discrete and process manufacturers.

- Prospects can avail themselves of the support provided with processing or turnkey systems, or buy software products for their own equipment.

- Prospects also are provided with an image of a vendor that understands manufacturing and that has a full set of products for manufacturing planning, forecasting, budgeting, tracking, linking, purchasing, accounting, and other functions that use a common data base.

b. Company Background

ASK was incorporated in 1974 to serve the manufacturing industry. It has acquired several companies, which has enabled it to extend the hardware platforms, software products, and clients that it serves. Its FY 1991 revenues were $343.9 million, a 66% increase over FY 1990 revenues of

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$207.5 million. During the first quarter of FY 1992, ASK restructured its business into The ASK Companies, which include the corporate function and three decentralized business units. ASK Computer Systems employs 900 people focusing on manufacturing applications.

Turnkey systems and software products for IBM, DEC, and HP midrange computers are the chief sources of revenue for ASK, but ASK also provides processing services and a few systems integration services.

c. Products and Services

ASK's primary offering is an on-line interactive system (the MANMAN Information System) that consists of integrated products for manufacturing, finance, marketing, customer service, decision support, and computer-integrated manufacturing functions. ASK Computer Systems has over 2,000 MANMAN clients worldwide.

The company is focusing on developing ERP solutions.

4. Dun & Bradstreet Software Services, Inc., 550 Cochituate Rd., Framingham, MA 01701, (508) 370-5000

a. Company Strategy

The company develops, markets, and supports a wide range of industry and cross-industry software products on multiple-vendor platforms that provide the opportunity to market to a number of industry markets.

- Applications software products are available for finance and accounting; human resources; and administrative, purchasing, inventory, manufacturing, education, and health industry functions.

- The AMAPS systems support discrete and process manufacturing environments on multiple-vendor platforms. A program is available to develop interfaces with the manufacturing software products of other vendors.

In addition to AMAPS systems, process manufacturers use Dun & Bradstreet software products for inventory control, human resources, accounting, financial reporting, and other standalone applications. Dun & Bradstreet also provides professional services aid in planning, using, and customizing software products.

D&B's software products utilize a number of hardware platforms—including IBM, Unisys, DEC, HP, and Bull mainframe and midrange equipment.

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b. Company Background

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America, which D&B acquired in 1990, and McCormack & Dodge, which D&B acquired in 1983. The former had been founded in 1963 and had over 24,500 product installations. The latter, founded in 1969, had over 10,000 product installations.

INPUT estimates that D&B Software's fiscal 1991 revenue was about $485 million, a 2% increase over fiscal 1990 revenue of $475 million. INPUT estimates that approximately 80% of the company's revenue is derived from applications software products and associated maintenance services and 20% from consulting and training professional services.

c. Products and Services

This vendor's software addresses a number of functions, as described in the following material:

- The Millennium Series supports human resources, accounting, and support functions—chiefly on IBM and compatible mainframes, but some products are also available for DEC VAX computers.
- The PLUS series offers accounting and a micro-to-mini link for IBM AS/400s and system/38s.
- Human resources products are available for IBM and compatible PCs.
- The BrightView Series—which allows the use of intelligent workstations and which addresses accounting, inventory, and budgeting functions—uses IBM mainframe and 9370 computers.
- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframes and minis, and for HP computers.
- Software products are also available for education and factory operations and other functions.

5. Marcam Corporation, 95 Wells Ave., Newton, MA, 02159, (617) 965-0220

a. Company Strategy

Marcam is one of the few applications software companies focusing exclusively on process manufacturing. Marcam recognized the unique manufacturing requirements of the process industries, and the lack of

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software systems designed exclusively for these industries. To meet those needs, the company developed and currently markets PRISM, an integrated manufacturing, financial logistics, and cost accounting software product.

Marcam worked very closely with more than 50 process manufacturers, many of which are among the Fortune 100, to develop the product. Marcam also provides implementation support, custom programming, and systems integration services for a total process manufacturing solution. As a result, the company has gained a good deal of respect from the process manufacturing industries, and is recognized as understanding the specific problems that exist within those industries. The company has cultivated this image, and is reaping the rewards as being a vendor with a very close relationship to process manufacturing specifically.

b. Company Background

Marcam was founded in 1980 as an applications software company. It distributed and provided add-on products and consulting services to MAPICS, IBM's manufacturing system for midrange computers, prior to developing the PRISM product.

In April, 1991, Marcam acquired ShawWare Incorporated of Burlington (Ontario, Canada), a supplier of maintenance and materials management applications software. The acquisition resulted in the addition of six modules to the PRISM product line. In March 1991, Marcam concluded an agreement with Advanced Software Design (ASD) that grants Marcam the right to market and support certain ASD software. The company's FY 1991 revenues reached $56.5 million, a 34% increase over fiscal 1990 revenue of $42.2 million.

Marcam is an Authorized Industry Applications Specialist and Business Partner with IBM. It was also one of the first companies involved in IBM's Cooperative Software (CS) program, and its product is the only manufacturing and control system included in the CS program. Marcam has combined its strategic relationship with IBM and its exclusive focus on the process manufacturing industry to establish itself as a leader in the marketplace.

c. Products and Services

The PRISM product family, introduced in 1986, includes an integrated planning and control software system targeted to process manufacturers. The software is designed for IBM AS/400, IBM system/38 and IBM PCs and compatible systems. Marcam has licensed over 3,600 PRISM modules for use at more than 650 sites worldwide. PRISM consists of 28 announced modules that are organized into four product lines—Production Series, Logistics Series, Maintenance Management Series, and Financials Series—as well as common functions or enablers.

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6. Ross Systems, Inc., 555 Twin Dolphin Drive, Redwood City, CA 94056, (415) 593-2500

a. Company Strategy

Ross Systems, Inc. provides business applications software products and associated support services to users of DEC computers. The company's overall strategy is to build a broad-based DEC application software company through internal development and selective acquisitions.

b. Company Background

Ross Systems was founded in 1972 to provide consulting professional services. In 1975, the company expanded its business to include software products and processing services. In November 1988, Ross Systems announced a management buyout of the company for an undisclosed sum. Since that time, the company has made a number of acquisitions.

Ross Systems' revenues for 1991 were $71 million. About 36% of those revenues were from the manufacturing industry, and 60% of manufacturing revenues were from process manufacturing.

In 1991, Ross Systems, Inc. announced that it had acquired Pioneer Computer Group of England in an attempt to extend its operations into the 4GL and process manufacturing software markets. This has allowed the company to become a player in the process manufacturing market by offering Promix, a pioneer product focused on this industry.

c. Products and Services

Promix allows process manufacturers to link the PLC, supervisory control and provide feedback from the plant floor. It is targeted to Fortune 100 companies in process manufacturing and provides specific solutions for consumer packaged goods, chemicals and pharmaceuticals/biotechnology. Promix makes use of 4GLs and offers the flexibility of relational data base management.

7. SAP America, Inc., International Court One, 100 Stevens Drive, Suite 350, Lester, PA 19113, (215) 521-4500

a. Company Strategy

SAP America, Inc. markets and supports the R/2 System, a fully integrated mainframe applications software system designed specifically to meet the information management needs of large corporations.

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SAP software currently is installed in 1,600 companies worldwide, including DuPont, Dow Chemical, Mobil Oil and Shell Oil. SAP views its customers as business partners and builds relationships based on a solid understanding of the customer's needs and business goals.

b. Company Background

SAP America was established in January, 1988 in Philadelphia, PA to market the R/2 System in the United States. Since that time, sales revenue has increased from $3 million to $16.7 million in 1990, with SAP currently running at an annualized sales rate of $25 million for 1991. Today, SAP America has nearly 200 employees and serves customers in the petrochemical, pharmaceutical, packaged goods, manufacturing, electronics, utilities and food industries.

c. Products and Services

One hundred percent of SAP America's 1991 revenue was derived from applications software products and associated support services. The R/2 System is an integrated set of ten business applications modules that manage a range of strategic business applications for data-intensive corporations with numerous locations and operations. The core of the R/2 System is the Basis System, which contains development tools for the system and provides interface capabilities that allow users to access data base information in any module from anywhere in the company.

8. Sterling Software, Inc.—EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017, (614) 793-7000

a. Company Strategy

Sterling's EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the company as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as their use of EDI expands. This strategy is supported with education and participation in the largest user group active in the EDI market.

The EDI Group has penetrated markets including wholesale and retail distribution—including grocery, hardware, and housewares—pharmaceuticals, medical/surgical distribution, and service merchandising.

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b. Company Background

The EDI Group was created in October 1990, and includes the Ordernet Services Division, The Ordernet International Division, the EDI Labs Division, and the Directions Division, which provides check processing and electronic payments software. The REDINET Services Division of CDC was acquired in 1991 and folded into the Ordernet Division. Fiscal year 1991 revenues were over $43.6 million, a 37% increase over fiscal 1990 revenue of $31.8 million. INPUT estimates that approximately 56% of the EDI Group's fiscal 1991 revenue was derived from software products and associated support services and 44% from network services.

c. Products and Services

Software products and network services are offered though the Ordernet division to over 2,700 customers in the pharmaceutical, grocery, hardware, housewares, retail, medical distribution, mass-merchandising, warehousing, transportation, and automotive industries.

Ordernet provides an on-line network to manage and control the flow of standardized business documents. As a result of acquisitions and internal sales, the EDI network services customer base increased by 163% during fiscal 1991, from 1,900 to 5,000 customers. The EDI software base went from 900 to 3,500 customers.

Services to certain industries are provided through vendors active in those industries. Ordernet services are made available to hospitals through GTE Health Systems. Services—including a data base on drug usage—are made available to the medical industry through International Health Applications.

Ordernet supports internetwork traffic with BT North America's EDI*NET. Other internetwork agreements have been established with GE Information Services, ARI, AT&T, Bell Atlantic and many others.

Electronic transmission of charge-back information between wholesalers and pharmaceutical manufacturers is provided in three formats established by national druggists' associations.

Translation between established standards for EDI and other standards and between a variety of record formats—as well as support of existing protocols on different hardware platforms—are provided with software from the EDI Group.

A data base service is also available to build on EDI documents—including purchase orders and invoices that trading partners use during business.

Security services, education, and software maintenance are also offered in support of EDI products and services.

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VI

Conclusions and Recommendations

A
Industry and IS Market Conclusions

The process manufacturing industry historically has been a host-based environment that relies on custom-developed applications to run its business. It makes use of process-level automation on the shop floor, but these systems have not been designed to integrate with IS systems.

The process manufacturing industries—including chemicals, petroleum, paper/pulp and food/beverage—have been feeling the impact of the U.S. recession. Now, due to factors such as global competition and regulation, process manufacturing companies face even greater challenges. Issues such as maintaining quality, optimizing manufacturing operations, efficiently managing the supply chain and cost-based pricing are becoming important factors in gaining competitive advantage, and there is growing recognition that information systems and services can play an important role in supporting efforts in these areas.

Process manufacturers recognize the need to make changes. Current trends show that many companies begin to downsize onto mini and PC-based platforms. While IS still handles the majority of applications development, companies in this industry are taking advantage of the increasing availability of packaged solutions. More solutions are being developed that address many of the unique needs of these industries. Advances in plant management systems and MRPII, ERP systems (which use RDBMSs and GUIs) facilitate integration of the enterprise.

In the process manufacturing industry, the normal flow of data/information is upward from the shop floor to corporate business applications. This flow makes on-line transaction processing (OLTP—network-based) systems particularly well-suited to implementing an integration strategy. Such systems can provide for the integration of data bases and a common communications protocol set, as well as interactive communication capability.

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Process manufacturers have been aggressive in using EDI and trading partners in the food, beverage, chemicals, and pharmaceuticals subsectors, and are increasingly viewing EDI as the only way to do business.

B
User Issues and Recommendations

Based on its research and analysis of the process manufacturing industries, INPUT has identified several areas of consideration for IS management:

- Maintain a focus on providing solutions to respond to business needs, as opposed to concentrating on applications development.
- Continue to evaluate migrating appropriate applications away from the mainframe.
- Emphasize open systems and interoperability in systems selection.
- Evaluate software options and use of systems integrators instead of in-house/custom development for new applications.
- Make use of tools such as CASE and 4GLs to support applications development efforts.
- Develop ongoing relationships with vendors whose primary focus is your *specific* industry.

C
Vendor Issues and Recommendations

Application requirements, especially at the levels of plant-floor information systems and business planning and control programs, can vary considerably among the different process industry subsectors. Therefore, major vendors to the process industries should possess strong capabilities (either internal or through partnerships) in professional services as well as in applications programming tools such as 4GLs and CASE tools so as to be able to customize solutions for individual clients.

Another crucial technology element required for successful longer-term viability as a vendor to the process manufacturing environment is the use of open systems architectures that can support data base management systems and communications standards.

A major product opportunity in the process manufacturing environment is in plant information/control systems and the integration of such systems with business planning and control and process design applications.

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Marketing manufacturing automation solutions to the process manufacturing industries requires the ability to justify programs not only on the traditional return-on-investment (ROI) basis, but also on the value of improved quality that can improve product position and shorten response times to changing market/customer requirements.

INPUT's recommendations for vendors to the process manufacturing industries are:

- Examine the requirements of the major vertical markets and focus solutions to specific needs within those industries. Develop strategic relationships with major customers in these industries.
- Where possible, employ open systems architecture to allow customers the flexibility to integrate different systems within the organization.
- Utilize CASE and 4GL/RDBMS tools for application development in order to gain the benefits of software development productivity, customization, and an integrated product strategy.
- Develop a sales approach that emphasizes the benefits of vendor support as opposed to in-house development.
- Provide solutions integrating plant floor, MRPII and process engineering software products.
- Develop a number of strategic alliances so as to be able to provide flexible systems integration strategies for the various needs of the process industry subsectors.

Companies with value-added network (VAN) offerings or other types of enterprisewide networking capability can provide solutions to the process manufacturing industries based on a processing services/facilities management delivery approach.

Future market requirements for vendors to the process manufacturing sector will include the ability to provide more of the total solution, a global focus, and additional attention to customer/supplier long-term relationships. Strong networking technology capability, available either internally or through strategic alliances, will also be necessary to provide the required enterprisewide solutions.

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A

Definitions

Computer-Integrated Manufacturing (CIM) - Integration of separately automated factory functions. These functions include MRPII, CAD/CAM/CAE, DSS, process control, ATE, and robotics. CIM is very complex and should be considered to require management change to commit to the technology and philosophy.

Closed Loop - A system with integral feedback, where the output is used to modify the subsequent inputs.

Discrete Manufacturing - A manufacturing environment characterized by the assemblage of individual elements. Discrete manufacturing includes three principal submodes:

- Job shop (customized)
- Flexible/discrete (characterized by frequent model changes)
- Repetitive (characterized by longer assembly lines and less frequent model changeovers)

Electronic Data/Document Interchange (EDI) - The use of a communications network to transmit and receive electronic business transactions between multiple locations on an intra- or intercompany basis.

Group Technology - The application of classification and coding technology to search a data base for information on similar parts and to apply this to CAD and CAM tasks.

Islands of Automation - An alternate way of referring to individual automated areas within a manufacturing enterprise (including product/process planning, product/plant engineering, manufacturing planning and control, and shop floor control).

Manufacturing Resource Planning (MRPII) - An extension of MRP, where MRP is integrated with financial planning, a simulation capability, and other functions on a closed-loop basis.

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Master Production Schedule - An anticipated build schedule that drives the MRP systems.

Material Requirements Planning (MRP) - A system to calculate material requirements on a dynamic basis using inputs from BOM, inventory status, open order status, and master production schedules.

Nesting - Software to automatically or interactively arrange patterns for parts within stock material boundaries.

Numerical Control (NC) - CAM technology and systems for generating numerically controlled machine tool programs.

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B

Data Base Reconciliation

A
Forecast Data Base

Exhibit B-1 presents INPUT's 1991-1997 market forecast for the process manufacturing sector.

B
Data Base Reconciliation

Exhibit B-2 presents the 1992 MAP data base reconciliation for the process manufacturing sector.

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EXHIBIT B-1

Process Manufacturing Sector
User Expenditure Forecast by Delivery Mode, 1991-1997

Delivery Modes	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
Sector Total	5,568	11	6,182	6,877	7,674	8,582	9,622	10,827	12
Processing Services	717	5	743	778	815	853	895	939	5
- Transaction Processing	717	5	743	778	815	853	895	939	5
Turnkey Systems	558	10	614	676	744	817	899	990	10
- Equipment	268	10	294	324	356	392	431	474	10
- Software Products	201	10	221	244	268	295	325	358	10
- Applications	174	10	191	210	231	255	280	308	10
- Systems	28	10	30	33	37	40	44	49	10
- Professional Services	89	10	98	108	118	130	143	158	10
Applications Software Products	595	15	683	783	899	1,036	1,198	1,378	15
- Mainframe	169	11	182	193	203	212	225	279	9
- Minicomputer	207	12	231	258	288	322	356	395	11
- Workstation/PC	219	23	270	332	408	502	617	759	23
Systems Operations	442	15	509	584	677	793	928	1,086	16
- Platform Sys. Oprns.	197	15	227	261	302	354	414	484	16
- Applications Sys. Oprns.	245	15	282	324	376	440	515	602	16
Systems Integration	324	11	360	402	456	520	596	686	14
- Equipment	148	11	164	184	208	236	272	312	14
- Software Products	20	11	22	24	28	32	36	42	14
- Professional Services	156	11	174	194	220	252	288	332	14
Professional Services	2,119	10	2,324	2,546	2,788	3,050	3,336	3,678	10
- Consulting	510	15	591	678	773	882	1008	1164	15
- Software Development	1310	6	1386	1474	1568	1589	1760	1866	6
- Education & Training	299	16	347	394	447	579	568	648	13
Network Services	813	17	949	1,108	1,295	1,513	1,770	2,070	17
- Electronic Info. Svcs.	708	16	821	952	1,104	1,281	1,486	1,724	16
- Network Applications	105	22	128	156	191	232	284	346	22

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EXHIBIT B-2

Process Manufacturing Sector
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 rpt (%)	91-96 CAGR per data 92 rpt (%)
	1991 Report (Fcst) ($M)	1992 Report (Actual) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($M)	1992 Report (Fcst) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)		
Total Process Manufacturing Sector	5,460	5,568	108	2	9,886	9,622	-264	-3	13	12
Processing Services	717	717	0	0	895	895	0	0	5	5
Turnkey Systems	568	558	-10	-2	1,000	899	-101	-10	12	10
Applications Software Products	595	595	0	0	1,198	1,198	0	0	15	15
Systems Operations	466	442	-24	-5	1,146	928	-218	-19	20	16
Systems Integration	170	324	154	91	391	396	5	1	18	14
Professional Services	2,119	2,119	0	0	3,336	3,336	0	0	10	10
Network Services	825	813	-12	-1	1,920	1,770	-150	-8	18	17

The user expenditures for 1991 are slightly higher than forecast last year, primarily due to modifications made in the area of systems integration. In addition, there are differences in turnkey systems, system operations, and network services.

INPUT has noted a number of recent systems integration projects contracted for by major process manufacturing companies. In addition, dollars that have previously been embedded in other categories have (more appropriately) been included in the systems integration figures. Therefore, the total SI market for 1991 has been adjusted from $170 million to $324 million.

However, due to the impact of the recession and a continued tendency on the part of many companies in this industry to handle this function themselves, INPUT has reduced the forecasted growth of systems integration between 1991 and 1992 from 12% to 11%, and lowered the forecast growth rate through 1997 from 18% to 14% to allow for the continuing strong impact of internal development. The growth rate of 14% for systems integration, however, still makes it one of the fastest growing delivery modes.

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As noted earlier, there has been substantial growth in the volume of applications software introduced that focuses specifically on process manufacturing. INPUT believes that the trend in this industry is toward applications software rather than turnkey solutions, and has therefore lowered the 1991 to 1992 growth rate for turnkey systems from 12% to 10%.

The recession and its impact on this industry, along with a strong sense of caution on the part of IS executives, has had an impact on the forecast for systems operations through 1997, although this delivery mode is forecast to grow at a CAGR of 16% between 1992 and 1997. Also slowing growth somewhat is the fact that many companies are still in the process of choosing architectural strategies and appropriate platforms and systems standards. Many firms indicated that once these decision are made, it will be much clearer which areas could benefit from outsourcing.

Network services, along with systems operations, is one of the fastest growing delivery modes. Though EDI is expected to continue to be a high-growth area, the estimate of 1991-1992 network applications growth has been reduced from 36% to 22%.

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Since 1974, INPUT has compiled the most extensive research base available on the worldwide information services market and its key segments, providing detailed market forecasts, vertical industry sector analysis and forecasts and analysis of vendor strategies and products. INPUT delivers specific expertise in the fast changing areas of outsourcing, systems integration, EDI/electronic commerce, software development/CASE, and on the impact of downsizing.

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I

Purpose and Organization

This Forecast Update provides the 1992 INPUT forecasts for the transportation sector and a discussion of recent market issues and competitive factors influencing the use of information services in this industry. The 1990 and 1991 reports presented more a comprehensive analysis of the components of the transportation sector, and should be used as a reference if necessary.

The transportation sector is composed of businesses in the following SIC groups:

SIC Group	Description
40xx	Railroad transportation, including freight operations, switching and terminal establishments
41xx	Local transportation
42xx	Motor freight transportation, including for-hire and common carriers
44xx	Water transportation, including freight and passenger
45xx	Air transportation, freight and passenger
47xx	Transportation services, including travel agencies, freight forwarding and custom brokerage

This chapter of the report describes its purpose and organization. The remaining chapters of the report are organized as follows:

- Chapter II—*Trends, Events, and Issues*—describes the current transportation industry and notes the factors that can have an impact on the use of information services.

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- Chapter III—*Information Services Market Forecast*—presents information services expenditures, by delivery mode, for the transportation market.

- Chapter IV—*Competitive Environment*—provides a review of recent competitive events, and vendor profiles.

- Appendix B—*Forecast Data Base*—gives a detailed forecast, by delivery mode, for the transportation industry. It contains a reconciliation to the previous year's forecast.

Related to this transportation sector report are two additional sector reports:

- Business Services
- State and Local Government

The collection of 15 INPUT market sector (or industry reports) and seven cross-industry reports constitutes INPUT's 1992 Market Analysis Program. These reports provide a complete overview of the U.S. information services industry.

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II

Trends, Events, and Issues

A

Environment and Market Changes

The overall performance of the transportation industry continues to be seriously affected by the air transportation subsector performance.

- Two more airlines ceased to operate in 1991, adding TWA and Metro Airlines to a list that includes Eastern, Pan American and Midway. America West and Continental filed for bankruptcy protection in 1991, while many others implemented restructuring of their operations.

- The airline industry incurred an operating loss of $3.9 billion and a net loss of $4.9 billion for the year ending June, 1991. Much of this loss is attributed to traffic growth remaining essentially flat and passenger bookings actually declining for both domestic and international flights.

Forecasts of air transportation revenues continue to indicate that it will not return to the rapid growth of the mid-1980s in the near future. The continuing recession—or slow recovery, depending on viewpoint—and aggregate change in vacation planning will continue to have an effect on air travel through at least the next three to four years. Recent airline fare wars attempted to provide a "shot in the arm" to the airline industry, enticing passengers to travel more. Many feel the attractive prices only changed the pattern of air travel plans; they didn't actually increase travel by a significant amount.

The IS departments have been called upon to control costs and help the airlines to survive by operating more efficiently. Additional investments in capabilities, including IS to serve increased international travel, will be required by most international carriers, including the major U.S. airlines. The volume of reservation calls that immediately followed the announcement of lower fares threatened to crash the computerized reservation systems. Similar to the situation of the late 1980s, the volume of calls exceeded the system's ability to handle those calls.

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Cargo service revenues have not suffered as much as passenger revenues. The economic downturn and the continuing volatility of the Middle East Gulf War, with its attendant threats of terrorist activity, have had more of an effect on personal and business travel than on the shipping of cargo. For example:

- The Gulf War was seen as a gift by the cargo shipping industry, with great amounts of material required to support the Mid-East effort.

- The need for air cargo operators to become more efficient and competitive has spurred the establishment of highly automated sorting hubs supported by a network of aircraft and ground vehicles, coordinated on a national level. Federal Express is one of the best examples of a cargo carrier with sophisticated, automated, and nationally controlled resources.

The trucking industry has been depressed since deregulation, but is not experiencing the losses that are occurring in the airlines.

- The trucking market is a fairly mature industry with as many as 47,000 competitors.

- The improvement in third-quarter 1991 GNP raised prospects for stronger motor carrier performance.

- Cost-cutting moves continue to take place in the trucking industry, with many carriers making use of direct payment EFT to reduce C.O.D. charges and downsizing the IS function to reduce costs.

In the competitive market for freight shipment, the railroad industry has managed to hold its own in freight competition with trucking, due to deregulation of prices and the use of containers and intermodal transport. In addition:

- In 1991, the 13 major freight railroad systems reported operating revenues of nearly $28.0 billion, and Amtrak carried over 22 million intercity passengers.

- For the 12 months ending June 1991, the railroad industry earned a 5.9% return on net investment. Since the Staggers Rail Act of 1980 that deregulated rail rates and services, the average return on investment has been 4 to 6 percent.

Railroads have experienced improvement in productivity due to technological innovations in equipment and computerized freight and train scheduling. Rail intermodal service grew from 3.1 million trailers in 1980 to 6.2 million in 1990.

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Water transport has continued to show a positive impact from container traffic and the growth of international shipping. The International Trade Administration (ITA) estimates that world import volumes will grow at rates above 5% per year through 1995.

The travel services segment of the transportation industry is suffering, to some extent, from the continuing slowdown in business and pleasure travel resulting from the recession, a weak dollar (causing disadvantageous exchange rates), and continued uncertain U.S. economic conditions. Vacation travel remained stable in 1991, rising 1% in volume over the previous year. The shift toward more weekend and "mini-vacations" continued in 1991. Other factors affected travel were:

- By the end of 1991, conditions for business seemed to have improved somewhat but were still not as good as those experienced in the mid-1980s.
- The summer of 1992 brought airline fare wars to entice travelers with bargain fares. Car rental companies rushed to increase the size of their fleets to accommodate the demand, even to the point of buying other than their regular make of car. But Business Travel News, in its November 1991 annual report, was expecting the reduced level of business travel, after the fare wars were over, to continue to have a negative impact on car rental companies.

Key transportation industry business issues are shown in Exhibit II-1. They remain essentially the same as those of 1991.

EXHIBIT II-1

Key Business Issues

- Using IS to aid in providing competitive advantage
- Slowed business resulting from the recession and a slow recovery
- Cost reduction pressures
- Downsizing
- Faster implementation of IS projects

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The transportation industry, as defined in Chapter I of this report, employs approximately 3.0 million people and is composed of firms engaged in the land, air, and water transport of people and cargo, as well as firms classified as travel agents. The use of pipelines to transport material, which has a SIC code in the transportation group (SIC 46), is excluded from the transportation industry in this report.

Opportunities for information systems vendors in the transportation industry vary by subsectors of the market. The following application areas offer opportunities:

- *The airline industry*—Opportunities exist for the enhanced use of computerized reservation systems to include hotel reservations and rental cars; the expanded use of information systems to plan crew schedules and other behind-the-scenes operations; the expansion of on-board computing applications; expanded use of expert systems in sales, maintenance, and service planning; cost reduction financial analysis and control systems; and expanded use of network systems to improve service and communication.

- The federal government is examining the possibility of a monopoly by proprietary airline reservation systems that use a preferential airline flight selection process that may not be in the best interest of the customer. For instance, the development of an interface between airline reservation systems would hamper any type of monopoly by agencies connected to a computerized reservation system (CRS).

- *Air freight*—There are opportunities for improved scheduling, freight tracking, order entry, accounting, financial analysis and service systems.

- *Trucking*—In the trucking segment, opportunities exist for enhanced systems to handle scheduling, tracking, transaction processing, accounting and financial analysis, and network applications. Of particular interest at this time is the processing of intermodal shipments, making use of technology to track shipments and handle billing for multiple shippers, and electronic funds transfer for the payment of services.

- Various firms are offering processing services to provide funds transfer capabilities to truckers, handle freight rating, billing and payment processing, and payment for services such as gas, tolls, and food required by drivers as they transport shipments.

- *Railroads*—The railroad industry continues to have opportunities for information services in areas such as upgrades of reservation systems, equipment control and scheduling, railcar tracking and management, financial analysis and auditing, networks providing customer information and services, and expanded use of electronic information.

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- *Water Transportation*—Opportunities in water transportation include survey, cargo booking, tracking, cost control and vessel performance.

- *Travel Agencies*—Travel agencies leverage many of the resources provided by the airlines they serve, but they will be examining upgraded systems to maintain information on their clients and prospects, and improved accounting and administrative systems.

The key technology trends, mentioned by vendors and users in the transportation industry, are listed in Exhibit II-2.

EXHIBIT II-2

Major Technology Trends

- Electronic tracking of freight
- The use of expert systems for many applications
- Continued downsizing and implementation of client/server technology
- Outsourcing of IS
- Processing of electronic forms (EDI)

B

Current Transportation Industry Events

There are many major developments that will affect the transportation industry over the next five years.

The expansion of major airlines into foreign markets continues. With the deregulation of air travel in Europe planned for 1993, U.S. airlines are starting to make inroads into the European market. American Airlines and United Airlines have been flying into London since 1991. The two airlines have not eroded British Airways' share of the European market.

Other U.S. airlines have also been making arrangements to expand their penetration of foreign markets during the past two years, and foreign airlines have likewise been active, investing in carriers in the U.S. and other countries and making arrangements to expand their routes throughout the world.

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- Foreign carriers such as Lufthansa are now using American promotional techniques for expanding business in the U.S. At the end of 1991, Lufthansa announced its promotional deals to expand business in the U.S.

- In the fourth quarter of 1991, Japanese and Chinese airlines announced major expansions of overseas flights, illustrating that the expansion of global travel is not limited to U.S. and European airlines.

As a result of the expansion of routes and competition, airlines have been adding planes. Northwest announced the addition of 20 aircraft at the end of 1991.

However, U.S. carriers are continuing to suffer from the recession, and there are periodic announcements of moves to save costs such as that by AMR (American Airlines) cutting 1,250 ground jobs in the beginning of 1992.

The U.S. House of Representatives passed legislation to put restraints on American Airlines' SABRE system, United Airlines' Apollo system and other airline-owned reservation systems. The legislation attempts to eliminate the system's bias toward the respective host carriers' flight and the contractual ties that make it difficult for agencies to change system vendors.

Early in 1992, Covia, the former United Airlines unit that developed the Apollo CRS, and Galileo, the CRS owned by a consortium of European carriers, announced a proposed merger to create the first global computer reservation system. Galileo International, the merged CRS, is expected to serve about 25,000 travel agencies worldwide.

Computerized reservation systems are expanding into additional areas to better service the business and pleasure traveler. The International Reservations and Information Consortium (INTRICO) was planned to provide airline reservations, hotel reservations, and car rentals simultaneously, to fully serve every need that the traveler has with one-stop service. The system was to be directly accessible to travel agencies via a real-time link to airline reservation systems (such as AMR's SABRE). The project was plagued with delays, and was finally canceled in July, 1992. Budget Rent a Car, Hilton Hotels, Marriott Hotels, and AMR Information Services (AMRIS) were the partners in the INTRICO project.

The Intelligent Vehicle Highway System under development by the Federal Highway Administration and several vendors will make use of radio, fiber, video, and computers to form an intelligent network capable of monitoring traffic flow, toll collection, on-board traffic reports, and giving directions to travelers.

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Smart cars, now under development, will assist business travelers to their destinations through the use of graphic user interface and computer screens in hotels and the cars to plot directions for the driver. This will be a great help to the car rental business, as it assists the traveler and gives the vendor a competitive edge.

Other enhanced services to airline passengers are currently being tested by USAir, GTE Airphone, and the GenStar System. These services include one-way air-to-ground communications, fax services, and modem hook-ups in the plane.

Major moves are being made to upgrade the capabilities of many firms involved in handling the transportation of freight:

- Burlington Northern Railroad has developed a UNIX-based client/server environment, allowing railroad operations specialists to schedule trains and optimize movement. Development productivity has been improved (by 85% to 100%) by offloading these applications from the mainframe to the client/server environment.

- CSX Transportation Inc. implemented a radio-frequency scanner system to oversee the delivery of large numbers of automobiles. The system has reduced the time necessary to search for and deliver products by 85%.

- The Harper Group, a holding company owning 12 specialized transportation businesses, uses a system that tracks the two-way movement of orders and inventories electronically and monitors the status of shipments. Information on international shipment is received through the electronic data interchange (EDI) system before the cargo arrives.

- In 1991, Sea-Land added to its fleet of ships; expanded arrangements with other water carriers and overseas rail organizations; and implemented a computer network that will track cargo around the world.

- Crowley Maritime Corporation has recently enlarged its information systems capabilities to provide more support to the business services supporting its cargo-line activities.

- An automated dispatching system that handles 3,000 vehicles operating out of eight offices is being implemented for Comcar Industries.

- Investments continue to take place in trucking to gain market share and reduce costs. Bar code technology to track movement of goods, Roadshow software to plan more efficient deliveries, satellite tracking of shipments, and smart vehicles to help travelers navigate will facilitate the movement of freight and are expected to improve the delivery, pricing, and financial performance of carriers implementing such techniques.

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The *Business Week* forecasts for 1992 earnings show increases for trucking and rail and water transportation of cargo, but continuing declines in airline earnings.

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III

Information Services Market Forecast

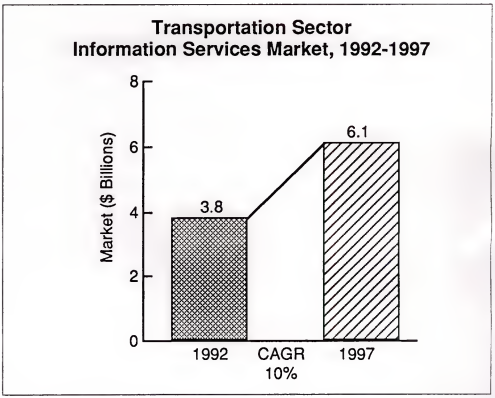
A

Total Market Forecast, 1992-1997

Information services expenditures in the transportation industry grew at a 7% rate in the U.S. between 1991 and 1992, up slightly from the 6% growth of the prior year.

The compound annual growth rate (CAGR) will increase to 10% for the period 1992 to 1997, as shown in Exhibit III-1, although growth will still be relatively low compared to other industries.

EXHIBIT III-1



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Expenditures will increase at a rate of 6%, from $3.6 billion in 1991 to $3.8 billion in 1992, and will grow at a CAGR of 10% to $6.1 billion in 1997.

Although the growth rates for expenditures on information services in transportation remain below average, there is still opportunity for some delivery modes serving this market. For example:

- Downsizing and the growing use of client/server architecture will provide opportunities for vendors selling applications software products for platforms of all sizes, but most notably for workstations and PCs.
- Systems integration and systems operations vendors will continue to find opportunities in the expansion and upgrading of maintenance, customer services and reservation systems for passenger and freight business.
- Increasing use of specialized electronic information systems and network applications, including electronic mail, VANs and EDI, will drive the use of network services.

B
Forecast by Delivery Mode

Although there have been some changes in the growth rates and expenditure forecasts, most notably for systems operations, the majority of the CAGRs have remained relatively constant, typically varying by only a percentage point or two from the 1991 forecast. The 1991 forecast considered the effects of the Gulf War and the sluggish economy and anticipated a late 1992 or early 1993 recovery. Current economic forecasts now expect a mid- to late-1993 economic resurgence, with steady, but relatively conservative growth throughout the forecast period.

Exhibit III-2 presents INPUT's forecast for the transportation sector by delivery mode.

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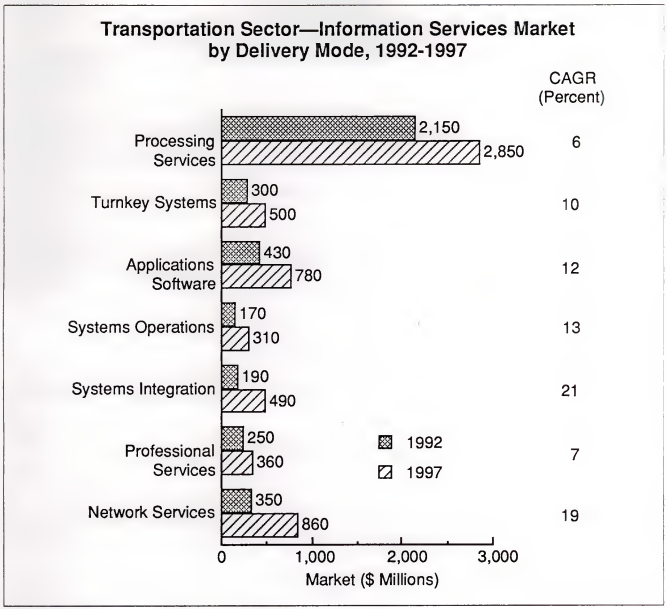
EXHIBIT III-2



1. Processing Services

Processing services recorded only a 3% increase in expenditures in the transportation industry between 1991 and 1992, growing from $2 billion to $2.1 billion.

Overall, this delivery mode had the lowest growth rate for information services delivery modes in transportation in 1992, and is projected to continue to have the lowest growth rate—6%—for information services modes in this industry between 1992 and 1997.

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Expenditures totaled $2.1 billion in 1992 and are projected to grow to slightly more than $2.8 billion in 1997. The absolute dollar growth between 1992 and 1997 will be $700 million—about one-and-a-half times as large as the growth in dollars of the next largest mode—indicating that processing services still offers an opportunity for vendors interested in providing information services to the transportation industry. The primary application driving this revenue is reservation systems.

However, the low rate of processing services growth reflects the fact that a number of transportation companies, particularly smaller ones, continue to select workstation/PC solutions rather than processing alternatives for accounting, inventory, and other applications.

2. Turnkey Systems

User expenditures for turnkey systems grew at a rate of 9% between 1991 and 1992, rising from $277 million to over $300 million in 1992. Expenditures will continue to grow at a CAGR of 10% between 1992 and 1997, rising to $500 million in 1997.

As a result of the control advantages and cost economies of workstation/PC, turnkey systems and software products, many users are continuing to select these delivery mode options. This trend is driving the cost of solutions down and holding the growth of turnkey systems to 10%, despite the continuing use of this mode.

3. Applications Software Products

Expenditures for applications software products will grow at a rate of 11% between 1991 and 1992, increasing from $387 million to $430 million. The growth rate (CAGR) will increase to 12% between 1992 and 1997, and expenditures will grow to $780 million by 1997.

The growth of expenditures is forecast to be much higher, at 20%, for workstation/PC software products, while the growth rates for mainframe and minicomputer applications software products will be 5% and 8%, respectively, between 1992 and 1997.

Forecast expenditures will be highest, at $421 million, for workstation/PC applications software products in 1997. This number will be more than the sum of the software product expenditures for mainframes ($189 million) and minicomputers ($166 million).

The high forecast for the use of applications software products for workstations/PCs is due to the continued interest of many small establishments in trucking, bus transportation and other transportation submarkets using downsized solutions, as well as the interest of larger firms in client/server applications that allow functions to be interconnected.

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4. Systems Operations

Over the planning period, from 1992 to 1997, systems operations is forecast to grow from $170 million to $310 million, at a CAGR of 13%. However, systems operations ranked as the smallest delivery mode in terms of expenditures in 1991 at $148 million, and in 1992 at $170 million, and will continue as the smallest through 1997. Even at this size, it will provide a reasonable business opportunity to systems operations vendors.

The reduction in both the absolute dollar amounts and the CAGR from the 1991 forecast are the result of some of the anticipated large outsourcing contracts for reservations systems (e.g., Hertz) being canceled in 1992, or indefinitely deferred. Loss of one or two such projects, with dollar values in the tens of millions, has an immediate effect on the forecast base, and a cumulative effect on the CAGR.

5. Systems Integration

In 1992, expenditures for systems integration will grow at a rate of 16% and increase from $164 million in 1991 to $190 million in 1992. Expenditures will grow at a higher rate, a CAGR of 21%, between 1992 and 1997 and will reach $490 million in 1997.

The transportation industry will offer significant opportunities for systems integration services between 1992 and 1997, and a number of large systems integration firms—including EDS, IBM, Andersen, Unisys, AT&T/NCR, and CSC—are showing a strong and continuing interest in the business.

The rapid growth of systems integration and the steady growth of systems operations expenditures indicates the high level of user interest in information services that provide support and interaction for the complex problems that can be encountered in the transportation industry.

6. Professional Services

Professional services will grow at a rate of 8% in 1992, as user expenditures increase from $233 million to $250 million. The CAGR is forecast to drop to 7% between 1992 and 1997 while user expenditures grow to $360 million.

Professional services will be one of the smallest and the slowest growing delivery modes by 1997. Users will tend to be attracted to SO and SI firms for large, complex systems needs, and turnkey systems and workstation/PC applications software products for other solutions.

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Professional services will generally be provided to modify turnkey and software product solutions by SI, SO, turnkey, and software product vendors. Some large-scale development will also make use of professional services aid, but only limited in-house work will be done with the aid of vendors.

7. Network Services

Network services will become the second largest service mode by 1997. Growing from a level of $306 million in user expenditures in 1991, network services will increase at a rate of 16% in 1992 and will reach $350 million in 1997. Between 1992 and 1997, expenditures are forecast to increase at a CAGR of 19% to reach $860 million in 1997.

The growth of network services is being driven by its fastest growing submode, network applications, which will have a CAGR of 24% between 1992 and 1997. This growth, in turn, is being driven by the rising use of EDI and electronic commerce to support ordering and payment to suppliers and from customers, and its growth reflects the need for faster means of initiating service.

In addition, the use of VANs and electronic mail to provide information to customers and suppliers will also drive the use of network applications.

The use of on-line data bases (EISs) with route and plane information as well as technical information for maintenance and route planning and economic and financial information for business planning are growing rapidly in transportation.

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IV

Competitive Environment

A
Recent Information Services Events

Firms continue to upgrade information systems capabilities, despite problems with the economy. In many firms it is the contribution of the information systems area that enables the firm to stay competitive and profitable. Events that characterize the investments being made in the transportation industry market are included in this section.

Executives from major transportation firms have pointed out the contribution of the IS department in the ability of the firm to stay competitive. Foreign firms dominating the Pacific shipping routes have used information systems to achieve their success.

Transportation firms are upgrading and adding new IS capabilities through many methods.

- Vendors are forming joint ventures to offer mobile transportation tracking capabilities. AT&T and Lockheed are implementing a test site for the Intelligent Vehicle Highway System (IVHS). Electronic toll collection is the first of the IVHS technologies implemented. AT&T is contributing its smart card technology and Lockheed is providing software and systems integration support. Lockheed is currently testing a truck-oriented system in six western states and Canada.

- United Parcel Service (UPS) is developing an in-house system to deploy a data-over-cellular system for its vehicles. McCaw Cellular Communications, GTE Mobile Communications, PacTel Cellular and Southwestern Bell have formed an alliance to support UPS in this project and to provide UPS with a unified billing and network management system.

The large, complex systems that have been developed in the transportation industry to aid competitiveness have increased interest in SI and SO vendors who have experience with complex projects. The number of projects being handled by these vendors is increasing:

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- Litton is implementing an automated materials handling and control system for American Holdings at Fort Worth.

- Oracle has an SI contract for a ship management system.

- AT&T has an SI contract for a ticket application system for the American Airlines terminal facility at Fort Worth.

These contracts illustrate the fact that many large projects will be implemented through arrangements with vendors as well as with in-house-managed development. Many improvements in capabilities are also being achieved with a minimal amount of development by upgrading processing power with compatible systems.

- Royal Caribbean Cruises upgraded its communications capabilities through an upgrade of its AS/400 computer installation.

- Crowley Maritime upgraded the processing of its mainframe applications through the installation of a Hitachi Data Systems computer.

Many application solutions are also currently being implemented using available software products or other means of reducing development work and cost.

- Burlington Northern Railroad has implemented a client/server environment utilizing an IBM RISC System/6000 server. The applications allow 40 to 50 railroad operations specialists to schedule trains and optimize their movement over 25,000 miles of track and through 8,000 terminals and stations across the country.

- Comcar initiated a plan to downsize its computer applications from a mainframe to a distributed group of UNIX computers. The scheduling, tracking and automated dispatching system that will be automated on this distributed system will be implemented by using applications software products from Concepts Dynamics and the Informix data base and 4GL.

- Bank America, NYNEX, and Marriott Corp. are among many companies and transportation carriers to implement systems for optimizing delivery routes using Roadshow from Routing Technology Software.

- The San Jose outlet of Avis Rent A Car System is testing five automobiles equipped with special computerized navigation systems. The NAVMATE system is programmed with Bay Area travel data, a video screen mounted in the control panel, and sensors that use both satellite global positioning and magnetic "dead reckoning" to track the car as it travels.

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B
Vendor Profiles

Various types of information services vendors active in the transportation industry are profiled in this section. Strategies, background information, and products and services of these vendors are reviewed to explore the range of competition in the industry.

Some vendors concentrate on limited sets of capabilities in one or a few functional areas or service modes in transportation.

- Sentry Data Systems has concentrated mainly on software products for the bus transportation market.

- GEIS provides EDI and VAN network applications services to transportation companies.

There is another group of vendors more interested in marketing a set of information services products and services that can meet a wide range of needs for customers and prospects. EDS, IBM, Unisys, Coopers & Lybrand, and other Big Six firms, as well as other vendors in the information services industry, are attempting to meet a wide range of needs in many types of transportation companies.

In addition to the companies profiled, many other information services vendors serve the transportation market, including IBM, AT&T/NCR, DEC, and GEIS.

Companies profiled are:

- American Software, Inc.
- Andersen Consulting
- ASA International Ltd.
- Bluebird Systems, Inc.
- Comdata Holdings, Inc.
- Concord Computing Corp.
- Dun & Bradstreet Software
- RAILINC Corp.
- Sterling Software, Inc., - EDI Group

Additional information about these companies or other vendors active in the transportation industry can be found in INPUT's VAP Program.

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1. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305, (404) 261-4381

a. Company Strategy

American Software has developed an integrated line of standard applications software products for IBM mainframe and AS/400 platforms. These products run singly or in combination to meet unique customer requirements.

American Software will perform professional services work to customize its software products to solve customer problems in process or discrete areas or in other industries.

b. Company Background

American Software was founded in 1970. The company grew to over 800 full-time employees in 1991, and its calendar-year revenues for 1991 reached over $100 million. The company provides applications software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation, and government clients.

c. Products and Services

Approximately 46% of American Software's revenues are provided by software products and about 41% from professional services. American Software is one of the most successful software product vendors in marketing professional services.

The applications software products that are sold can be divided into two groups:

- Forecasting and inventory management software that accounts for about 9% of revenue
- Purchasing, materials control, and financial software that accounts for about 37% of revenue

Many of the manufacturing modules developed by American Software can be used in other industries. These include master scheduling, materials requirement planning, bill of material, capacity planning, production work status, shop floor control, and cost management and tracking. The Distribution Resource Planning (DRP) module plans the replenishment of goods.

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2. Andersen Consulting, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602, (312) 580-0069

a. Company Strategy

Andersen utilizes its reputation and knowledge of a group of industries as well as demonstrations of working solutions to industry problems as a means of appealing to and closing business with prospects. Andersen focuses more attention on manufacturing than on other markets, but has extended its capabilities to retail and wholesale distribution as well as to banking, utilities, and transportation.

Andersen Consulting provides professional services and systems integration services to a number of transportation industry segments, including motor carriers, ocean carriers, airlines, airport facilities, railroads, and intercity bus companies.

Some of the services supplied to transportation involve the use of Andersen's manufacturing expertise and software products for maintenance and repair work, and the electronic exchange of data with engine and airframe manufacturers.

Andersen emphasizes its knowledge of industries and applications to make presentations and conduct consulting studies that can lead to large SI and professional services contracts. By studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings at companies that it contacts. The firm uses acquisitions and alliances to gain additional resources and knowledge to address its areas of interest.

b. Company Background

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its rapidly growing and large volume of information services business. Estimated worldwide revenues in 1991 for Andersen Consulting were $2.26 million; U.S. revenues increased by about 21% to $1,230 million in 1990.

c. Products and Services

Over half of 1990 revenue derived from systems integration and about 25% from professional services. Systems operations revenue increased to about 8% of revenue in 1990, and revenue was also obtained from applications and systems software products and network services.

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Application areas in transportation in which Andersen specializes are focused principally on airline needs, as shown below:

- Maintenance engineering
- Revenue accounting
- Reservations
- Change management
- Ground services
- Cargo operations
- Catering

Andersen also provides distribution and logistics solutions for single-mode and intermodal freight shipments.

3. ASA International Ltd., 10 Speen Street, Framingham, MA 01701, (508) 898-2727

a. Company Strategy

ASA International develops, markets and supports integrated systems for international trade, independent tire dealer, manufacturing, and law firm markets. In 1990, ASA acquired its largest competitor, Trade Data Services, Inc., expanding the range of services that can be offered.

b. Company Background

ASA provides services to the transportation industry through the International Trade and Transportation Group. This group accounted for approximately 32% of the total 1991 revenue of $23.5 million.

c. Products and Services

Turnkey systems and software products are available to prepare documents required for information exchange with U.S. Customs and international shipping companies. Other transportation-related systems extract data from Customs' computer, send faxes from DEC VAX computers to any fax machine, and automatically fax shipment information status to selected customers.

- The International Trade and Transportation Group provides software and services to comply with U.S. Customs regulations, track the movement of goods and paperwork, and perform invoicing and general-accounting functions.

- The Customs House Documentation System prepares the form required to complete an import shipment, calculates import duties and service fees, prepares invoices, processes liquidations, and tracks missing documents.

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- The Automated Broker Interface extracts entry summary data from the Customs House Documentation System, formats it, and electronically transmits the data to the U.S. Customs computer to facilitate shipment release and document filing.

- Export systems, based on IBM and DEC hardware, process information for air and ocean export. The systems are able to automatically check the credit of a shipper, validate shipment information, prepare bills of lading, route shipments for multi-branch companies, assign waybills, calculate freight charges and commissions, consolidate multiple shipments, and track shipments.

4. Bluebird Systems, Inc., 5900 LaPlace Ct., Carlsbad, CA 92008, (619) 438-2220

a. Company Strategy

Bluebird offers a set of microcomputer systems software and application products for manufacturing, transportation, distribution and other industries that can be sold through VARs. Applications software products make use of its systems software capabilities.

One set of applications software products, TRANSPRO/2, is a vehicle management system that addresses the total needs of a common carrier freight company.

b. Company Background

Bluebird Systems was founded in 1982 to develop microcomputer systems and applications software products that could be sold on a nationwide basis through VARs. INPUT estimates that Bluebird Systems' 1991 revenues were about $25.0 million.

c. Products and Services

One of Bluebird's key systems software products is SuperDOS, a version of DOS that provides a multiuser, multitask environment. Application products make use of SuperDOS, so it is an added advantage to customers as well as an added source of revenue to Bluebird and its VARs.

Compilers for COBOL, Pascal and Databus are also marketed.

Applications software products include systems for manufacturing and vehicle management. The latter, TRANSPRO/2, includes the following capabilities:

- Freight billing, accounting, and settlement
- Freight manifesting
- Fuel and mileage reporting

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- Interline payables
- EDI
- Vehicle investment analyzing
- Vehicle maintenance reporting

5. Comdata Holdings Corp., 5301 Maryland Way, Brentwood, TN 37027, (615) 370-7000

a. Company Strategy

Comdata provides services to the trucking industry that are focused on the use of network capabilities to service and manage truck drivers and trucks. The development of these services provided opportunities and ideas for the extension of services to the leisure, gaming and retail industries.

Using a specialized credit card, truck drivers can use the services of Comdata to obtain fuel, pay for repairs and fuel bills, and obtain travel cash and other services at participating truck stops, with dollar amounts and controls set by the trucking company.

- Reports of all activities are prepared for truck companies.

- Fuel use can be monitored and fuel tax recorded as part of Comdata's services.

- During 1991, Comdata processed about 27 million funds transfer transactions, valued at $4.3 billion for approximately 11,000 trucking companies.

Comdata provides detailed pick-up and drop-off directions for drivers, to make use of available capacity after a drop-off, and the use of transceivers to supply many types of regulatory permits.

b. Company Background

Comdata was restructured in 1987 through a leveraged recapitalization initiated by Welsh, Carson, Anderson & Stowe. Comdata Network and a number of other activities, including funds transfer and permit issuing capabilities, have been acquired since the recapitalization.

c. Products and Services

In addition to the services described above for the trucking industry, Comdata provides credit card cash advance services for individuals at leisure and resort locations, and check verification, check guarantee and collection services for various retailers.

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6. Concord Computing Corporation, 2525 Horizon Lake Drive, Suite 120, Memphis, TN 38133, (901) 371-8000

a. Company Strategy

Concord provides a full range of processing services through five business units for the authorization, control, and settlement of consumer transactions at retail locations. Target services include credit card authorization, data capture, and settlement bank card services; check authorization and settlement services; cash card and cash forwarding truck services; EFT services to financial institutions; and terminal and communications equipment to transaction networks, retailers, and banks.

b. Company Background

Concord Computing Corporation, incorporated in 1970 in Massachusetts, is organized into several business units, most of which operate autonomously. Fiscal year 1991 revenues reached $48.1 million; the Trucking Services business units represented $10.1 million (21%) of total company revenues. This was a 31% increase in revenues to the trucking industry, from $7.4 million in fiscal year 1990.

c. Products and Services

Services directed to the transportation/trucking industry allow drivers to purchase fuel and services and receive cash advances at over 4,000 truck stops nationwide.

- The trucking companies are issued plastic cards by the EFTS subsidiary. When the driver uses the card for cash, fuel or services, EFTS approves and records the transaction and reimburses the truck stop daily for transactions. The costs for the EFTS services are shared by the truck stop and the trucking companies.

- This data and other driver information is made available to the trucking companies.

7. Dun & Bradstreet Software Services, Inc., 550 Cochituate Rd., Framingham, MA 01701, (508) 370-5000

a. Company Strategy

The company develops, markets, and supports a wide range of industry and cross-industry software products on multiple vendor platforms that provide it the opportunity to market to a number of industries.

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- Applications software products are available for financial and accounting, human resources, administrative, purchasing, inventory, manufacturing, education, and health industry functions. Software products for these functions are utilized in the transportation and other industries. Its distribution resource planning system (DRP) is heavily used in transportation.

- The AMAPS systems support discrete and process manufacturing, and maintenance environments in other industries—including transportation—on multiple vendor platforms. A program is available to develop interfaces with the manufacturing software products of other vendors.

In addition to AMAPS systems, companies use Dun & Bradstreet software products for inventory control, human resources, accounting, financial reporting, and other standalone applications. Dun & Bradstreet also provides professional services aid in planning, using, and customizing software products.

Through its CIM Partners program, D&B has relations with Vocam Systems, a company that specializes in distribution and has software products that can be used by trucking and other transportation companies.

D&B's software products utilize a number of hardware platforms, including IBM, Unisys, DEC, HP, and Bull mainframe and midrange equipment.

b. Company Background

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America, acquired in 1990, and McCormack & Dodge, acquired in 1983. The former had been founded in 1963 and had over 24,500 product installations. The latter, founded in 1969, had over 10,000 product installations.

c. Products and Services

D&B's software addresses a number of functions, as described in the following:

- The Millennium Series supports human resource, accounting and support functions, chiefly on IBM and compatible mainframes, but some products are also available for DEC VAX computers.

- The PLUS series offers accounting and a micro-to-mini link for IBM AS/400s and System /38s.

- Human resources products are available for IBM and compatible PCs.

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- The BrightView Series, which allows the use of intelligent workstations and addresses accounting, inventory and budgeting functions, uses IBM mainframe and 9370 computers.

- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframes and minicomputers and HP computers.

- Software products are also available for education, factory operations, and other functions.

8. RAILINC Corporation, 50 F Street N.W., Washington DC 20001, (202) 639-5580

a. Company Strategy

RAILINC was founded as the data processing subsidiary of the Association of American Railroads (AAR) to provide EDI, other industry data bases, and software products to the transportation industry. Clients include rail, ocean, and motor carriers, manufacturers, and distributors.

b. Company Background

RAILINC, founded in 1982, is the information processing subsidiary of the AAR. The company grew to over $15.0 million and about 140 employees by the end of the decade. Its services are targeted to the railroads and associated industry segments, such as motor carriers, manufacturers, and distributors.

c. Products and Services

Approximately 80% of RAILINC's revenue is derived from network services and the remainder from software products.

Network services include the CLM Collection Services, EDI, a Data Exchange System, and other railroad data bases that are maintained and accessed through RAILINC.

- The CLM Collection Service electronically communicates with major rail carriers and shippers to provide car locations to consignees, shippers' agents, and trucking companies.

- The Data Exchange System consolidates car hire and car repair information from over 95 railroads and provides them to rail car owners in computer-processable form.

- The EDI service allows electronic communication with rail, ocean, and motor carriers, and trucking companies. Documents frequently exchanged include purchase orders, invoices, shipment tracing messages, bills of lading, freight bills, and administrative messages.

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- Data bases maintained by RAILINC include an international freight car data base, TRAIN II, and a computerized rail car tracing and pool management service, UMLER.

- Software packages are available to assist shippers in tracing rail shipment, to mechanize car repair billing procedures and access the Data Exchange, and to allow electronic access to RAILINC's data bases and network communication software.

- The Short Line Management System is designed to provide general business and transportation software specifically for small rail carriers, and is IBM compatible.

9. Sterling Software, Inc., - EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017, (614) 793-7000

a. Company Strategy

Sterling's EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the company as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as their use of EDI expands. This strategy is supported with education and participation in the largest user group in the EDI market.

Markets that the EDI Group has penetrated include wholesale and retail distribution—including grocery, hardware and housewares, trucking, and pharmaceutical, medical/surgical distribution and service merchandising.

b. Company Background

The EDI Group was created in October, 1990 and includes the ORDERNET Services Division, the EDI Labs Division, and an EDI International Division, headquartered in London. The REDINET Services Division of CDC was acquired in 1991 and folded into the ORDERNET Division. Fiscal-year 1991 revenues were over $43.6 million, with an estimated 95% of revenues coming from the U.S.

c. Products and Services

About 55% of the EDI Group's revenue comes from software products and 45% from network services. Software products and network services are offered though the ORDERNET division to over 2,700 customers in the pharmaceutical, grocery, hardware and housewares, retail, medical distribution, mass merchandising, warehousing, transportation and automotive industries.

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ORDERNET provides an on-line network to manage and control the flow of standardized business documents among over 2,000 trading partners.

Electronic transmission of charge-back information between wholesalers and pharmaceutical manufacturers is provided in three formats established by national druggists' associations.

Translation between established standards for EDI and other standards in use and between a variety of record formats, as well as support of existing protocols on different hardware platforms, are provided with software from the EDI Group.

A data base service is available to build on EDI documents such as purchase orders and invoices that trading partners use during business.

Security services, education, and software maintenance are also offered in support of EDI products and services.

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A

Definitions

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B

Information Services Market Forecast

A

Forecast Data Base

Exhibit B-1 presents INPUT's detailed 1991-1997 forecast for the transportation sector.

B

Forecast Reconciliation

Exhibit B-2 presents the reconciliation of INPUT's 1992 transportation sector forecast with the 1991 forecast.

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EXHIBIT B-1

Transportation Sector
Market Size Forecast by Delivery Mode, 1991-1997

Delivery Modes	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
Sector Total	3,585	7	3,828	4,154	4,550	4,982	5,496	6,112	10
Processing Services	2,070	3	2,132	2,239	2,373	2,516	2,667	2,827	6
- Transaction Processing	2,070	3	2,132	2,239	2,373	2,516	2,667	2,827	6
Turnkey Systems	277	9	302	332	366	402	448	495	10
- Equipment	134	8	145	159	176	193	216	238	10
- Software Products	99	10	109	120	132	145	161	178	10
- Applications	85	11	94	103	113	125	139	154	10
- Systems	14	7	15	17	18	20	22	24	10
- Professional Services	44	9	48	53	59	64	71	79	10
Applications Software Products	387	11	431	478	538	596	670	776	12
- Mainframe	140	6	149	155	169	175	182	189	5
- Minicomputer	105	9	114	124	135	147	156	166	8
- Workstation/PC	142	18	168	199	234	274	332	421	20
Systems Operations	148	13	167	188	213	239	270	306	13
- Platform Sys Oprns	108	1	109	121	135	148	165	183	11
- Applications Sys Oprns	40	45	58	67	78	91	105	123	16
Systems Integration	164	16	190	228	276	335	414	494	21
- Equipment	61	13	70	83	101	123	151	181	21
- Software Products	10	10	11	14	17	20	26	30	22
- Applications	7	14	8	10	12	14	18	21	21
- Systems	3	0	3	4	5	6	8	9	25
- Professional Services	89	17	104	124	150	182	224	268	21
- Other	5	20	6	7	8	10	13	15	20
Professional Services	233	8	252	271	291	312	331	355	7
- Consulting	55	11	61	69	76	83	90	98	10
- Software Development	146	7	156	164	173	185	195	209	6
- Education & Training	32	9	35	38	42	44	46	48	7
Network Services	306	16	354	418	493	582	696	859	19
- Electronic Info Svcs	231	15	265	308	358	418	493	595	18
- Network Applications	75	19	89	110	135	164	203	264	24

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EXHIBIT B-2

Transportation Sector
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 Rpt	91-96 CAGR per data 92 Rpt
	1991 Report (Fcst) ($M)	1992 Report (Actual) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($M)	1992 Report (Fcst) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)	(%)	(%)
Sector Total	3,580	3,585	5	<1	5,892	5,496	-396	-7	10	9
Processing Services	2,070	2,070	0	0	2,980	2,667	-313	-11	8	5
- Transaction Processing	2,070	2,070	0	0	2,980	2,667	-313	-11	8	5
Turnkey Systems	275	277	2	1	443	448	5	1	10	10
Applications Software Products	390	387	-3	-1	661	670	9	1	11	12
Systems Operations	148	148	0	0	377	270	-107	-28	21	13
Systems Integration	164	164	0	0	412	414	2	<1	20	20
Professional Services	233	233	0	0	333	331	-2	-1	7	7
Network Services	300	306	6	2	686	696	10	1	18	18

Overall, INPUT's forecast in 1991 reflected a generally conservative attitude toward revenue growth for the transportation sector in an economy undergoing a lingering recession, and the 1992 numbers tended to validate that conservatism. The figures for the 1991 market were very consistent, with only a small variation in the forecast expenditures for turnkey systems, applications software products, and network services.

In regard to the 1996 market forecast, the two areas in which major changes have occurred are processing services and systems operations.

The 1992 forecast of 1996 processing services expenditures fell 11%, or $313 million below INPUT's 1991 estimate, due primarily to the unexpected rapid growth in the purchase of workstation/PC solutions. These purchases, in turn, have been driven by the tumbling prices for PCs—prices that have driven the cost of PC solutions to virtually a commodity level, with PC prices in 1992 at less than half of what they were in 1991.

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Wide availability of low-cost, plug-and-play applications products for fundamental business activities such as accounting and inventory control have also fueled the rapid growth of the PC platform, and reduced expenditures for processing services alternatives.

Although 1991 market estimates were accurate for the small base of systems operations expenditures, the forecast for the 1996 market anticipated that a number of large outsourcing contracts for reservations systems (most notably, Hertz) would be successfully concluded, adding to both the present base and the longer term growth of this delivery mode. When these contracts were either canceled or deferred, they had a major impact on the forecast for 1996, dropping revenues for systems operations by $107 million and the 1991-1996 CAGR from 21% to 13%. INPUT believes that these are not lost expenditures, but merely deferred decisions, and anticipates that within the next year or two, as the economy returns to a healthy condition, such systems operations expenditures will resume their strong growth.

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About INPUT

INPUT is a worldwide consulting and market research firm uniquely focused on the information technology services and software markets. Executives in many technically advanced companies in North America, Europe, and Japan rely on INPUT for data, objective analysis, and insightful opinions to support their business plans, market assessments, and technology directions. By leveraging INPUT's considerable knowledge and expertise, clients make informed decisions more quickly, and benefit by saving on the cost of internal research.

Since 1974, INPUT has compiled the most extensive research base available on the worldwide information services market and its key segments, providing detailed market forecasts, vertical industry sector analysis and forecasts and analysis of vendor strategies and products. INPUT delivers specific expertise in the fast changing areas of outsourcing, systems integration, EDI/electronic commerce, software development/CASE, and on the impact of downsizing.

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Information Services Market Analysis Program

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Information Services Opportunities & Trends 1992-1997 Forecast Update

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I

Purpose and Organization

The purpose of this Forecast Update is to provide the 1992 INPUT forecast for the utility industry market, with commentary on recent market and competitive issues.

INPUT analyzes utilities as a vertical market that includes the electric, gas, and water/sewage/waste disposal segments. Electric utilities can be investor-owned, cooperative, municipality-owned, federally owned, or state projects/power districts. Gas utilities consist of pipelines (transmission) and distribution (local) companies. Water/sewage/waste disposal utilities can be publicly or municipally owned, or privately owned.

The SIC (Standard Industry Classification) for this market is 49 (491-497). Telephone and cable television services are discussed as part of the telecommunications vertical market (SIC 48).

The remainder of this report is organized as described below:

Chapter II—Trends, Issues, and Events—provides background information on the business issues and trends that are driving the use of information services within the utility industry.

Chapter III—Information Systems Market—presents information services expenditures by delivery mode and submode for the U.S. utility market.

Chapter IV—Competitive Environment—provides a review of recent competitive events, and vendor profiles.

Appendix A-Definitions-refers the reader to INPUT's separate volume of industry definitions.

Appendix B-Forecast Data Base-gives a detailed forecast by delivery mode and submode for the utility industry. It also contains a reconciliation to the 1991 forecast.

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A collection of all 15 INPUT market sector or industry reports, 7 cross-industry reports, and 9 delivery mode reports constitutes INPUT's 1992 Market Analysis Program. Together, they provide a complete overview of the U.S. information services industry.

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II

Trends, Issues, and Events

A
Trends

1. Supply and Demand

Most current estimates indicate annual growth of about 2% in electric demand for the remainder of the 1990s. Will enough generation capacity be in place to meet this demand? At this growth rate, the U. S. may require 200 new large coal or nuclear plants by 2010—and little is being planned by utilities to address this need. Large plants can take as long as ten years to become operational.

Interestingly, according to Cathy Zoi, chief of energy productivity and pollution prevention at the EPA, personal computers now account for five percent of commercial energy use.

Gas demand has been relatively flat in recent years, but there is an expectation that demand will accelerate as gas continues to be used more to generate electricity as well as in vehicle fleets. Gas supply fluctuates with demand. Increasing demand provides increased incentive to produce more gas.

2. Regulatory Environment

a. Climate of Deregulation

Utilities have followed the deregulation path of the airline and telephone industries. Basically, the gas pipeline industry has been deregulated. The trend begun in the Reagan administration continues as the Federal Energy Regulatory Commission (FERC) moves toward open access to electric transmission.

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At the distribution level, as in the telephone industry, deregulation is more difficult to accomplish. This is an area in which a natural monopoly occurs, caused by the poor economics of having side-by-side telephone or electric lines—or gas, water, or sewer pipes. At the distribution level, it is more logical to look for "re-regulation" rather than deregulation, implying tightening rather than loosening of state government oversight.

In 1991, the Department of Energy released the long-awaited first edition of a National Energy Strategy (NES). Its goals are to increase conservation, diversify the fuel mix, promote new technology and lower prices—all while achieving environmental balance. The document met with the expected mixed reviews and its implementation has faltered.

The Clean Air Act offers some innovative flexibility in the regulatory field, enabling utilities to buy and sell credits, putting specific economic value on environmental costs. It has also weakened the traditional camaraderie among utilities by dividing them along lines of self-interest.

b. Consumerism and the PUCs

Although technically representing consumer and utility interests, most PUCs (many of which are elective) tend to side with consumers' short-term interests. Utilities try to maintain positive public relations to help assure a cooperative PUC, and thus spend a great deal of executive time with the PUC.

c. Bureaucratic Implications

The regulatory fishbowl in which utilities operate engenders an unusually conservative philosophy. The prudence of utility decisions is always subject to question by politically influenced second-guessers. Rate cases are supported by immense paperwork, and the number of rate cases is increasing after a steady decline throughout the 1980s. The Nuclear Regulatory Commission's paper requirements have been overwhelming since the Three Mile Island accident in 1979, albeit licensing requirements have been relaxed recently. Still, it is unlikely that any utility will undertake new nuclear construction on its own in the next few years.

3. Increasing Competition

The monopolistic nature of utilities suggests the absence of competition, and utilities, with their conservative approach to business, can hardly be considered cutthroat. However, in recent years it has become increasingly apparent that the humdrum style of many utilities has given way to an era of more intense competition.

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a. Gas versus Electric

Competition among different fuel sources is hardly new. The basic rivalry has always been between gas and electricity. This competition is normally limited to industrial and heating/air conditioning markets. Unconstrained by the contradictory forces of marketing versus conservation that afflict many electric utilities, gas companies continue to be the more aggressive marketers.

b. IPP/Cogenerators

Encouraged by federal regulators, independent power producers and cogenerators offer new dimensions of competition for utilities. Both of these entrants have a tendency to use gas as fuel for their generators. The result is a ratchet effect between electric and gas rates.

c. Resurrection of Marketing

After the oil crisis of 1973, marketing went out of fashion for electric utilities. Marketing departments shrank and, renamed, refocused on conservation. The theme was: let me help you not use my product. Contradictory as this seems, conservation continues to be preached by many electric utilities, beholden as they are to the PUCs. Some 30 states have encouraged conservation by allowing utilities to treat related costs as though they were an investment in plant. The Edison Electric Institute estimates that through the 1990s, demand-side management will obviate the need for 24,800 megawatts of new electric power, the equivalent of 72 coal-fired plants. However, as larger utility customers have begun to discover that there are alternatives to local utilities, the latter have reacted by reintroducing true marketing into their methods and organizations.

Exhibit II-1 summarizes the major trends affecting the utility industry.

EXHIBIT II-1

Key Trends in Utilities

- Supply/demand uncertainties
- Re-regulation
- Competition
- Cost containment

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4. Cost Containment

To deal with a competitive world, utilities have fallen in line with much of corporate America in focusing on the cost side of the equation. For many years, utilities were looked on as cost-plus businesses. Indeed, that is basically the nature of the regulatory compact that traded monopoly status for the obligation to serve. But today, both cost-plus and the obligation to serve are under intense pressure. Notice that as utilities rename themselves, the term *service* often drops out.

a. Low-Cost Supplier

The phrase "low-cost supplier" is frequently heard in utility boardrooms today. It suggests that the days of cost-plus are past and the modern utility must adopt more aggressive management approaches to deal with a new era. In many utilities, more aggressive approaches begin at the top where, more frequently, outsiders (some with telephone backgrounds) are assuming management responsibility.

b. Downsizing/Rightsizing/Capsizing

As utilities assume a lean and mean stance, they have taken a knife to the fat that gathered during less-contentious times. Most utilities have already been through at least one painful downsizing exercise. There is little argument that the industry was ripe for downsizing. More recently, the term *rightsizing* has been used to describe the process. In all this, many utilities are focusing on changing their corporate cultures to match the leaner times.

B
Issues and Events

1. Diversification/Bankruptcy/Mergers

a. Diversification

During the 1980s many utilities found themselves with excess cash generated by rates that had finally caught up with the regulatory lag of the 1970s. Constrained as they were to a rate of return determined by the PUC, utility managers attempted to expand their horizons by entering into diversified businesses.

For some, this expansion consisted merely of dabbling in fields related to the core utility business. Others pursued related endeavors more vigorously. Some entered entirely different businesses, such as savings and loans and insurance. Few efforts at diversification prospered. With some exceptions, utility managers have now decided to stay with what they know best.

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b. Bankruptcy

The never-can-happen happened. A utility went bankrupt. Saddled with immense debt caused by cost overruns at the Seabrook Nuclear plant, Public Service of New Hampshire went belly up. Since then, the Columbia Gas System, Tucson Electric and El Paso Electric have been added to the list.

c. Mergers

When Iowa Electric Light and Power merged with Iowa Southern, rumors of additional merger activity in Iowa were rife.

The $2.8 billion merger of San Diego Gas & Electric with Southern California Edison, which would create the nation's largest electric utility, was blocked by the California PUC.

PacifiCorp, owner of Pacific Power & Light and Utah Power & Light, attempted to acquire Arizona Public Service but was beaten back. PacifiCorp continues to think in terms of expansion, creating nervousness among its neighbors.

Northeast Utilities acquired Public Service of New Hampshire.

2. Environment

Environmental issues are having a significant impact on utilities for a variety of reasons, including the current political climate, and concerns over broad, long-term issues such as the greenhouse effect.

Buoyed by passage of the Clean Air Act, environmental activists are now focusing on higher-hanging fruit, such as lawnmowers.

3. Fuels

a. Nuclear

The Three-Mile Island (TMI) accident triggered an intense focus on the safety of U.S. nuclear plants. The result was a massive increase in Nuclear Regulatory Commission regulations that impacted existing nuclear plants and caused the cancellation of all orders for new plants. No new nuclear plants have been ordered since 1979.

The result of these regulations has been to dramatically increase the cost of operating nuclear plants. Indeed, although the economic justification for a nuclear plant was to have been its cheap fuel, the staffing requirements at U.S. nuclear plants are sufficiently expensive to more than offset the fuel savings. Since TMI, staffing levels have risen from 150 employees per plant to over 1,000. As a result, in addition to the astronomical

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capital costs of bringing a nuclear plant on-line, the operations and maintenance expenses are higher than a comparable-capacity coal plant—a bitter disappointment for those who had bet on the promise of nuclear power. The pill became even more bitter as four nuclear utilities announced the premature retirement of their nuclear facilities.

b. Gas

The advantages of gas suggest that it is to be the preferred fuel for the 1990s. But, because gas heats 56% of U.S. homes, distribution profits can suffer dramatically in unusually warm winters, as has been the case in much of the country in recent years.

c. Other Fossil Fuels

The natural gas industry has contended that greater use of its fuel could reduce oil dependence and help achieve a cleaner environment in the bargain. As for coal, the effects of the Clean Air Act were viewed by some as making it difficult—and in some regions impossible—to increase the electrical output of coal-fired power plants to meet increasing demand.

d. Alternate Energy Sources

Interest in alternate energy sources, such as geothermal, solar and wind, peaked in the 1980s. Only geothermal energy achieved proven economic justification. Recently, because of technological advances, wind turbines have been receiving renewed interest from utilities. A recent low-tech approach has been the massive planting of shade trees to reduce summer air conditioning (peak) demand.

Exhibit II-2 summarizes the major issues driving the utility industry.

EXHIBIT II-2

Key Utility Issues

- Diversification/bankruptcy/mergers
- Environmental impact
- Fuel mix

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III

Information Systems Market

A

Delivery Mode Analysis

There are significant differences among the commercial, engineering, and operations organizations and applications within a utility. These differences result in varying approaches to information software and services. The information systems organization today actively considers the applicability of outside solutions before deciding on in-house development. This consideration is clearly taking place in areas such as resource management, but also increasingly in the previously sacrosanct customer system. On the engineering side, applications packages are commonly used, while operations favors a more customized, systems integration approach.

Exhibit III-1 illustrates the primary delivery modes by application. It is not intended to suggest a cookie-cutter view of this relationship, but rather a general perspective of the market and its breakdown into commercial, engineering, and operations segments. The following describes some of the major considerations, by delivery mode.

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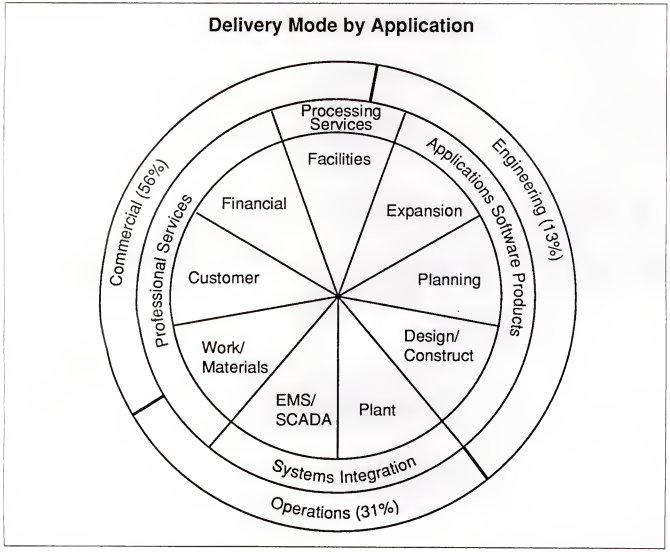
EXHIBIT III-1



1. Processing Services

Relatively small utilities, such as REAs and municipal utilities, frequently use processing services for day-to-day transaction processing.

An important, sometimes overlooked market is the conversion of facilities records to computer form—a labor-intensive, one-time but long-term, multiyear effort.

The complexity of "nuclear codes" (nuclear-plant-unique engineering programs) and the high-performance requirements to run these number-crunchers have led to a significant on-line, frequently interactive, market in this niche of 70 or so electric utilities with nuclear power plants.

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Utilities have long understood the concept of peak shaving. Hence, the use of outside resources is normal business procedure. Outsourcing of systems operations, described below, will most often include significant software development/maintenance activities. As a result, growth in the professional services market will be accelerated by the complementary growth of systems operations.

7. Systems Operations

Interest in data center operations outsourcing grew appreciably during 1992 with the first major contracts—Yankee Gas and Washington Water Power. Precedent thus set, outsourcing of the central data center will receive increased consideration as cost pressures continue in the next few years. The gross market potential here is over $5 billion in electric utilities alone.

A special consideration in utility outsourcing is that utility capital expenditures form a part of the rate base on which utilities earn a return. Consequently, a utility should maximize its rate base by assuring that information systems operations (and therefore the associated capital costs) are part of the utility itself. On the other hand, these expenses are rather inconsequential and the rate base has become less of a factor in the rate-making process.

Consistent with their conservative approach, major utilities can be expected to require trial marriages with outsourcing vendors before committing to long-term relationships.

As shown in Exhibit III-2, INPUT projects that the information services market within the utilities industry will grow from $1.55 billion to $2.75 billion, a CAGR of 12%, over the five-year period from 1992 to 1997. Twelve percent is consistent with the 12% average annual growth rate projected by INPUT for the 1991-1996 period.

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2. Network Services

The major uses of network services in utilities are the traditional LEXIS/NEXIS-type services.

Demographic data bases, available either on-line or as a package, offer utilities a complementary view of their customers and prospects and are a useful addition to a marketing support system.

Perhaps the greatest growth potential for network services in utilities is EDI, which enables on-line interchange between utilities and their many suppliers. The logical extension is to tie utilities into their major corporate customers as well.

3. Applications Software Products

The use of applications software products is growing rapidly in the industry. Cross-industry applications—e.g., stockholder and administration human resources (not considered in this report)—are the most widely accepted. However, the use of utility-unique application code, often modified by the utility or the vendor to meet the specific requirements of the individual utility, is also growing rapidly. Customizing, particularly for larger utilities, is the rule, not the exception.

4. Turnkey Systems

Utility operations organizations frequently refer to their sensor-based control systems as turnkey systems. However, these often employ specialized hardware and are considered systems integration projects in this report. Small utilities, frequently having less than 50,000 customers, are the core turnkey market in utilities. The application set is usually limited to customer support systems, with an emphasis on billing.

5. Systems Integration

The major operations-type applications in utilities are all systems integration opportunities. In addition, there is an increasing requirement to integrate operational systems with other corporate systems. This integration is intended to enhance overall efficiency of day-to-day operations, and to align them with strategic goals such as power brokering.

6. Professional Services

Two elements favor the use of professional services: on the systems side, the increasing complexity of modern technology makes it difficult for utilities to permanently retain staff with the necessary technical skills; on the applications side, the age (10-20 years) of these systems—plus the many retirement incentive programs—have left utility staffs devoid of the application know-how needed to develop replacement systems.

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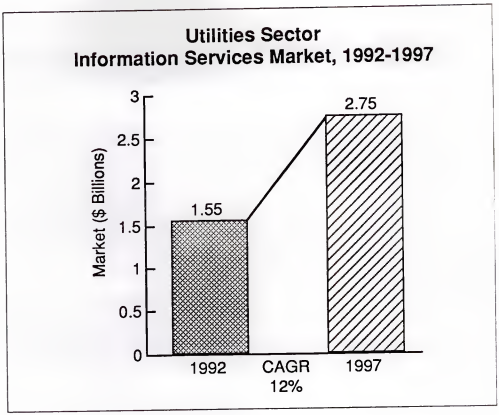
EXHIBIT III-2



The forecasted growth of each delivery mode is depicted in Exhibit III-3.

- *Systems operations* activity will accelerate appreciably, albeit from a relatively small base. Historically, information systems investments—including the corporate data center—have added to the investment base and thus the measurement relative to rate setting by the PUC. Changes in this orientation, already apparent in recent outsourcing decisions, make systems operations a true alternative in the utilities industry.

- There is significant growth in *applications software*, driven by large utilities opting to use packages, trading their tradition of internal development for cost and response considerations.

- There is also significant growth, albeit slower, in the *systems integration* delivery mode, largely driven by increasing activity in SCADA/EMS and power plant control systems aimed at optimizing the use of existing facilities.

- *Processing services* growth has upward pressure from facilities management conversion services that is slightly offset by declining transaction processing services in the low-end market. The latter will be impacted by increasing penetration of *turnkey system* customer solutions.

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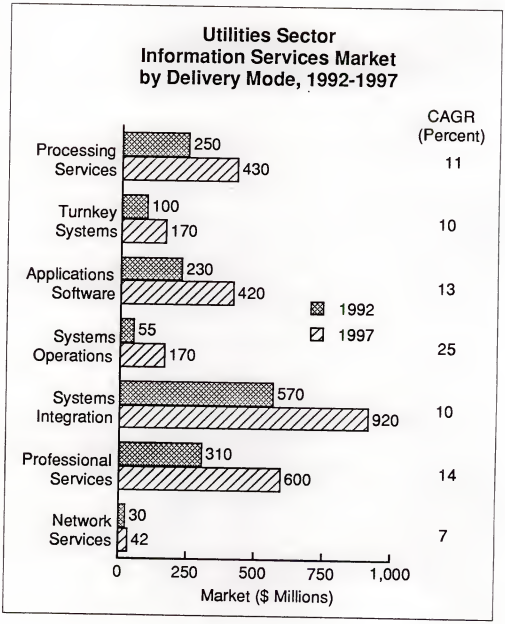
- *Network services* growth is influenced by the slow but inexorable growth in utility EDI. However, because most utilities are regional, their needs for network services do not match those of other industries. The market for these types of services is quite modest in the utilities industry.

- *Professional services* growth, though constrained by dampening demand for unique high-function customer systems in favor of more packaged applications software solutions, will accelerate as the concept of out-sourcing takes hold in utilities. Most vendors will attempt to parlay their outsourcing relationships into utility application credentials by remarketing developed code. However, utility applications software not originally developed for a broad market is usually only a foot in the door to selling professional services.

EXHIBIT III-3



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IV

Competitive Environment

A

Recent Information Services Events

Vendors of software and services to the utility niche find themselves in a market of unaccustomed turbulence as cost pressures, downsizing (diminished IS staffs), and application obsolescence engulf the market. The result has been increased focus on alliances, both among vendors and with customers. Increasingly, hardware manufacturers espouse open systems and seek application-oriented relationships to gain product differentiation. Services vendors are capitalizing on the need for staff augmentation brought about by across-the-board early retirement programs. Applications software vendors continue to enjoy an expanding market. Noteworthy events include:

- The first operational open energy management system was installed by Stagg Systems at Iowa Electric Light & Power (also supporting Iowa Southern and the Central Iowa Power Cooperative).
- In 1992 the first investor-owned data center outsourcing contract was signed by EDS with Washington Water Power.
- IBM entered the outsourcing market by setting up Integrated Systems Solutions Corp. as a subsidiary.
- Seimens acquired EMPROS, an energy management system supplier previously affiliated with CDC, adding to the non-USA ownership of the majority of firms in this niche.
- DEC initiated a marketing arrangement with NCC and Deloitte & Touche to provide complementary support of utilities worldwide.

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B
Vendor Profiles

Eight information services vendors are profiled in the following paragraphs.

1. Andersen Consulting, 2 North Central, Phoenix, AZ 85004, 602-251-2627

Utilities are one of the six vertical markets addressed by Andersen Consulting, the largest integrator of utility information systems. Approximately 10% of Andersen's 22,000 worldwide professional employees are involved with utility systems at any time.

Andersen Consulting competes across the entire utility application spectrum in all delivery modes, but with particular emphasis on systems integration for customer, financial, maintenance, distribution, plant and facilities management systems. Approximately half of Andersen's systems integration business is fixed-price. Worldwide net utilities revenue for the 1991-92 fiscal year were $245.5 million (about half in the U.S.), an increase of 59% over the prior year.

Andersen offers a CASE technology called FOUNDATION, which is composed of METHOD/1, PLAN/1, DESIGN/1, and INSTALL/1 and FCP (FOUNDATION Cooperative Processing). CUSTOMER/1 is a specific implementation of this technology for utility customer solutions, which represent about 45% of Andersen's revenue stream. Also under FOUNDATION are TPS/1 (Total Plant System), WORK/1, a T&D work management system and, most recently, POMS (Plant Operations and Monitoring System).

A key strategy for Andersen Consulting focuses on the selection and training of quality professionals. Their skills, which are geographically dispersed, are leveraged by centrally located pockets of expertise at the Dallas-based Utility Technology Center. Extensive networking capabilities are used to optimize the availability of critical skills for specific customer needs. Andersen's packaged solutions are typically the outgrowth of specific utility engagements, although alliances with other suppliers are not precluded. Given its pre-eminence in the international utilities marketplace, Andersen Consulting can be viewed as a formidable competitor in all aspects of information systems services for utilities.

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2. Digital Equipment Corporation (DEC), 200 Forest Street, Marlboro, MA 01752, 508-467-5111

Recently, DEC has asserted itself more forcefully in the utility market, particularly in the commercial applications area. In November 1991, DEC announced agreements with Network Computing Corp. (NCC) and Deloitte & Touche to offer products and systems integration services worldwide to the utilities industry. The market for customer support systems is a key focus of DEC's effort. Under the agreements, DEC, NCC and Deloitte & Touche will market customer systems based on VAX computers; NCC supplies applications software; and Deloitte & Touche provides industry and application consulting using its 4Front CASE system.

DEC also indicated its utility focus by being the first major computer vendor with networking products in support of the Utility Communications Architecture (UCA) specifications developed by the Electric Power Research Institute (EPRI) in conjunction with EDS and Andersen Consulting. In April, 1992, DEC's systems and applications integration services were more fully articulated with the announcement of DECunity, a utility-focused standards framework that includes UCA, POSIX, OSI and DAIS (Database Access Integration Services, also developed by EPRI). The DECunity effort will include the ability to tap Digital's application and services resources of over 29,000 professionals at 450 locations in 83 countries.

DEC has long enjoyed a strong presence in utility engineering and operations applications, typically marketing in conjunction with systems integrators. Its announcement of Alpha has raised both excitement and trepidation among business partners attracted by significant technical advancement. Over a thousand of these had begun to port to Alpha by the fall of 1992. DEC's utility business is growing at 26% with 2,500 utility customers worldwide. Its increased emphasis on the utility vertical seems to be paying off.

3. Electronic Data Systems (EDS), 7171 Forest Lane, Dallas, TX 75230, 214-490-2963

EDS provides a wide variety of services involving the selection, application, and support of information systems technologies. In 1991, EDS recorded $7.1 billion in revenue.

EDS's utilities focus is part of its Energy Strategic Business Unit (SBU). The broad strategy is to offer a range of services that depend on the needs of the specific utility, but are not limited to traditional facilities management. The company enhances these services with offerings that recognize the growing cost containment interest in utilities. The Energy SBU expects to grow at more than 20% compounded annually; EDS plans to be a leading provider of information technology services to utilities by 1995.

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EDS competes across the entire range of delivery modes, but with particular emphasis on systems operations outsourcing, systems integration, professional services, and network services.

EDS's 28 years of experience have resulted in particularly strong skills in large commercial systems, data base technologies, and multivendor connectivity. This mix of skills lends itself nicely to the development of customer support systems in utilities as well as the integration of discrete systems in power plants. In addition, EDS has extensive experience in large financial systems.

Recently, EDS acquired the 200-person Energy Management Associates (EMA) organization in Atlanta and gave it responsibility for its U.S. utility interests. The firm specializes in consulting and software for utilities and its acquisition is indicative of EDS's taking a more application-oriented view of the utilities market rather than having a generic outsourcing focus. EDS also acquired SD Scicon, a U.K.-based firm with considerable utility engineering skills. If these two groups can be coordinated effectively, EDS will have a formidable presence across the utility application spectrum.

4. IBM Corporation, 44 South Broadway, White Plains, NY 10601, 914-288-3085

Since 1988, IBM has taken a somewhat belated interest in the utilities services market, first with a foray into the customer service market with an offering called UCDS (Utility Customer Design Service) and then in 1992 with a specific focus on utilities in its newly formed subsidiary, Integrated Systems Solutions Corp (ISSC). Major customer systems projects are under way at Niagara Mohawk and Northern Indiana Public Service, with the latter expected to yield applications software.

ISSC was successful in assuming data center operations responsibility for Yankee Gas and has been quite aggressive in pursuing outsourcing opportunities throughout the industry.

IBM is attempting to capitalize on the breadth of its field organization, which still represents formidable numbers despite significant downsizing in recent years. IBM is marketing software developed by Cooperative Software Partners (CSP), an organization that currently includes: M3I, a subsidiary of Hydro Quebec specializing in distribution management; Saratoga Systems, focused on marketing systems; and Severn Trent, a Birmingham, U.K. water company, pursuing multiple U.S. utility application opportunities.

From rather meager beginnings considering its overall size, IBM has succeeded in doubling its professional services revenue in utilities each year since 1988, a pace that will lead IBM to become a major player in a few more years.

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5. NCR Corporation, 1700 South Patterson Blvd., Dayton, OH 45479, 513-445-4463

NCR Corporation has directed its energies on large investor-owned U.S. utilities. In doing so, NCR emphasizes its traditional computer strengths complemented by AT&T's networking and the UNIX operating system. The result is an open, cooperative computing strategy emphasizing client/server that will benefit as utilities swing into distributed environments throughout the rest of the 1990s. Software offerings include COOPERATION, an object-oriented development tool for application integration, and TOP END, which supports on-line transaction processing in a UNIX environment. These products complement NCR's seven levels of computing—from the notepad to massively parallel processors.

NCR's support tools translate into specific utility application targets: the ubiquitous customer system; image, featuring support of plant E-size drawings; and mobile support tying field operations to facilities data bases. In general, NCR's utility industry strategy is to pursue these opportunities through business partners that complement its systems offerings.

6. STAGG Systems, Inc., 901 Threadneedle, Houston, TX 77079, 713-496-3470

STAGG Systems, Inc. is an energy management system (EMS) supplier specializing in turnkey systems to the electric utility industry. In 1990, STAGG acquired the MPRO division from EI, and expanded its offerings to include work management (maintenance) systems.

STAGG was founded in 1970 and from its inception has focused on power systems applications, process computing, man-machine interfaces, data acquisition, on-line data bases, and intercompany communications. STAGG has pioneered many innovative EMS concepts, including a modular design that withstands obsolescence, the industry's first large-scale state estimator, the first interactive multi-user load flow (a major program that calculates electrical measurements within a network), and the first full graphics system.

In 1989, STAGG became a wholly owned subsidiary of Arizona Public Service Company. Coincident with that acquisition, STAGG focused its development resources on the first distributed, workstation-based, open EMS in the industry. This was announced as EMS/6000 in February 1990, coincident with IBM's announcement of the RISC System/6000.

EMS/6000 offers an EMS solution under UNIX with distributed workstations interconnected by a high-performance Token Ring LAN and software written in the easily ported C language. The first open EMS in the world was installed by STAGG at Iowa Electric in 1992.

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STAGG's strategy is to capitalize on its lead as well as its real-time and application strengths to expand vertically in the real-time field (SCADA, Distribution Automation) and horizontally into related application areas (work management, facilities management, etc.) through growth, alliances and acquisition.

7. Synercom Technology, Inc., 2500 City West Boulevard, Suite 1100, Houston, TX 77042, (713) 954-7000

Synercom provides integrated AM/FM solutions to the utilities, telecommunications and government sectors. It employs 120 people and, in 1991, had $15 million in revenues, about half from utilities. Several years ago, Synercom phased out its hardware manufacturing operations in favor of a systems integrator role predicated on its base software offering, INFORMAP/RDBMS. Consequently, Synercom has embraced a vendor-independent strategy exploiting UNIX portability and has signed agreements with DEC, DG, SUN and IBM for hardware, and ORACLE for DBMS. Synercom has additional agreements with Power Technology Inc. (load flow), Hansen (water maintenance), ABB (CADPAD), and Stoner (fluid modeling).

As the market increases its focus on distribution automation, Synercom has expanded its offerings to include a work management function using the same relational data base as INFORMAP. Future plans include further integration with SCADA and trouble reporting systems.

8. TTI Technologies, Inc., Presidents Plaza, Suite 350, 4902 Eisenhower Blvd. , Tampa, FL 33607, 813-281-1002

TTI Technologies specializes in systems integration and software product solutions for electric and gas utilities. TTI is a wholly owned subsidiary of AGS Information Services, which in turn is owned by NYNEX. Formed in 1986 as TECO Technologies, a joint venture between Tampa Electric and its principals, TECO Technologies was acquired by AGS in late 1989 and its name changed to TTI Technologies.

TTI's flagship is its mobile communications/dispatching product. Mobile Data Exchange (MDX) enhances communications between the office and field personnel by linking mobile field terminals to the central processor over a radio communications network. MDX runs on an IBM AS/400 or a PS/2 and supports a variety of utility field applications, including service order and trouble call processing, meter work, appliance installation and service, and credit and collections. TTI has used a variety of mobile data terminals in support of MDX, including Kustom Electronics, Grid Systems and IBM's PCradio. TTI's affiliation with IBM is that of Industry Application Specialist.

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TTI markets a work management system, Distribution Construction Information System (DCIS), that complements its MDX offering and provides a comprehensive DB2 solution to that related area. TTI's Meter Records and Inventory System (MRIS) is also a DB2 solution for meter inventory, installation history and testing.

TTI has shown steady growth and has gained appreciable experience in working with over 75 utilities. In 1972, TTI and Price Waterhouse (PW) announced a strategic alliance for the joint marketing of utility products and services. As a result, PW's Evolution 2000 customer system and TTI's MDX and DCIS will be made available as complementary offerings.

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A

Definitions

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B

Forecast Data Base

A

Forecast Data Base

Exhibit B-1 presents the detailed 1992-1997 forecast for the utilities sector.

EXHIBIT B-1

Utilities Sector
Market Forecast by Delivery Mode, 1992-1997

Delivery Modes	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
Sector Total	1,373	13	1,547	1,730	1,937	2,171	2,434	2,732	12
Processing Services	226	12	253	281	312	346	384	427	11
- Transaction Processing	226	12	253	281	312	546	384	427	11
Turnkey Systems	94	11	104	115	126	139	153	168	10
Applications Software Products	201	12	225	254	287	325	367	415	13
- Mainframe	45	9	50	53	56	60	64	73	8
- Minicomputer	65	8	70	78	86	95	102	115	10
- Workstation/PC	91	15	105	123	145	170	201	227	17
Systems Operations	37	48	55	68	86	107	134	167	25
Systems Integration	518	10	570	627	689	758	834	918	10
Professional Services	269	15	309	353	402	458	522	596	14
Network Services	28	8	30	32	35	37	40	42	7

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B
Data Base Reconciliation

Exhibit B-2 presents the detailed 1992-1997 forecast reconciliation for the utilities sector.

EXHIBIT B-2

Utilities Sector
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 Rpt (%)	91-96 CAGR per data 92 Rpt (%)
	1991 Report (Fcst) ($M)	1992 Report (Actual) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($M)	1992 Report (Fcst) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)		
Sector Total	1,330	1,373	43	3	2,330	2,434	104	4	12	12
Processing Services	217	226	9	4	421	384	-37	-9	14	11
Turnkey Systems	93	94	1	1	172	153	-19	-11	13	10
Applications Software Products	202	201	-1	-0	366	367	1	0	13	13
Systems Operations	29	37	8	28	55	134	79	179	14	25
Systems Integration	512	518	6	1	914	834	-80	2	12	10
Professional Services	249	269	20	8	359	522	163	56	8	14
Network Services	28	28	0	0	43	40	-3	3	9	7

Expenditures for 1991 were 3% above the forecast. This was largely attributable to a spurt in professional services driven by significant downsizing of IS staffs. Systems operations expenditures exceeded the forecast as the industry showed signs of moving more rapidly into the outsourcing alternative.

Forecasted expenditures for 1996 of $2.4 billion are 4% above the previous forecast of $2.3 billion. The forecasts for systems operations and professional services were raised significantly, reflecting growth of an outsourcing philosophy in utilities. Turnkey systems and processing services growth rates were lowered as a result of the prolonged economic slowdown and deferral of conversion expenditures for facilities management and low-end turnkey customer systems.

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I

Introduction

A

Purpose and Methodology

This report is provided as part of INPUT's U.S. Information Services Market Analysis Program. The telecommunications sector is one of 15 industry-specific sectors defined by INPUT as part of the information services industry.

The telecommunications sector was analyzed using information regarding telecommunications expenditures for information services and data from INPUT's Vendor Analysis Program (VAP). This material was used in conjunction with INPUT's data base and files to prepare the forecast in Chapter IV.

Frequently used acronyms and other technical terminology used in this report and related to the information services industry and the telecommunications industry sector include:

- Compound Annual Growth Rate (CAGR)

- Information Systems (IS) - Hardware and software systems and services required to acquire, manipulate, store, move, have access to, and report large amounts of data to users in a meaningful way. These programs include the traditional data processing and telecommunications services required to satisfy a company's internal information needs.

- Information Services - The term used to describe the software and services industry (vendor revenues) and markets (user expenditures).

Definitions unique to the telecommunications industry are shown in Appendix A.

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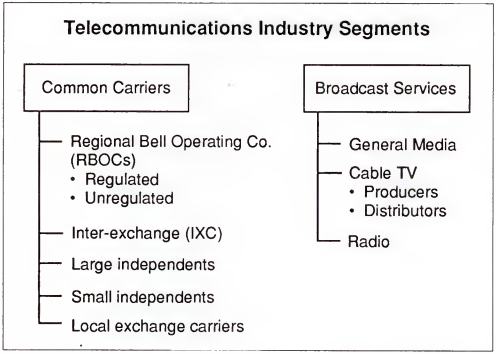
B
Industry Structure

The industry is divided into two major segments. The first is comprised predominantly of traditional common carriers (telephone and circuit providers). The second is comprised of broadcast service providers, such as general media and cable TV service providers. The categories are derived from the Standard Industry Classification (SIC) code for Communications (SIC code 48).

A composite industry structure is shown in Exhibit I-1.

EXHIBIT I-1



There are several groupings of common carriers. They include the Regional Bell Operating Companies (RBOCs), part of the Regional Holding Companies (RHCs); the inter-exchange carriers (IXCs); several large independent providers; a number of smaller independent providers; and many smaller local exchange carriers (LECs).

The RBOCs include regulated entities that primarily provide basic transport services to predefined areas throughout the United States. They also include non-regulated entities that have emerged since deregulation. The non-regulated entities can provide a wide variety of services to customers throughout the world. The RBOCs are shown in Exhibit I-2.

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EXHIBIT I-2

Regional Bell Operating Companies

- Ameritech
- Bell Atlantic
- Bell South
- NYNEX
- Pacific Telesis
- Southwestern Bell
- U.S. West

Inter-exchange carriers (IXCs) provide service among the local service areas of the RBOCs. Major IXCs are shown in Exhibit I-3.

EXHIBIT I-3

Inter-exchange Carriers

- AT&T
- MCI
- Sprint

In addition to the providers in these two categories, there are numerous independent service providers. Contel is now the largest independent provider, resulting from a merger with GTE.

Considered in total, there are an estimated 2,000 providers of telephone and circuit services. However, the majority of the industry's revenues are realized by the top 10 to 12 companies. Exhibit I-4 shows an estimate of the division of basic service revenues among the common carriers.

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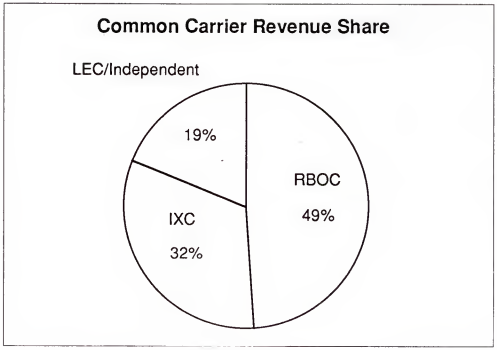
EXHIBIT I-4



Providers of broadcast services fall into three basic groupings:

- General media broadcasters. These include the major networks (ABC, CBS, NBC and Fox), which are supported by over 650 affiliated and 400 independent stations.

- Approximately 70 cable TV program networks. These provide programming to more than 9,500 cable systems throughout the country.

- More than 10,000 licensed radio stations

The market for information services can be divided into three distinct groups:

- The RBOCs and IXCs, identified in Exhibits I-2 and I-3

- Numerous local and independent providers. Local providers may be able to provide only basic services. Independent providers frequently focus on a specific product or service. Information service needs are significantly different for these two types of providers.

- Providers of broadcast services. These include public broadcast services such as ABC, CBS, and NBC; cable TV program networks and broadcasters; and radio stations.

In total, there are an estimated 22,000 organizations in the telecommunications sector that have requirements for information services. These can be divided into the three broad categories noted above and shown in Exhibit I-5.

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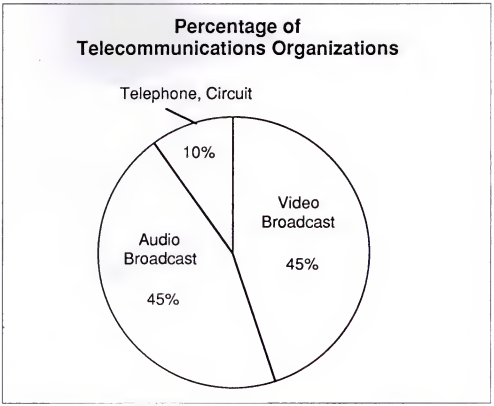
EXHIBIT I-5



A vendor must recognize that 10% of the organizations providing telephone and circuit services account for the majority of information services expenditures. However, there are several other areas within the broadcast industry where expenditures are significant. These are discussed in Chapter IV.

C
Organization and Contents

The balance of this report is organized into five chapters and two appendixes:

- Chapter II discusses major trends, events and issues affecting the telecommunications sector.
- Chapter III discusses the information systems environment in the telecommunications sector. This chapter considers how information is used, the impact of new technologies on the use of information systems, and issues related to budgets and organizations.
- Chapter IV provides a forecast for information services in the telecommunications sector. Following the forecast for the sector, each delivery mode is analyzed.

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- Chapter V discusses the competitive environment within the telecommunications sector.
- Chapter VI provides a summary of major areas of opportunity and makes recommendations to vendors entering or expanding their role in the telecommunications sector.
- The chapters are followed by two appendixes. Appendix A provides definitions related to the telecommunications sector. Appendix B includes the data base used for the forecast. Appendix B also offers a reconciliation of this year's projection with last year's forecast.

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II

Trends, Events and Issues

A
Trends

Chapter II discusses general business trends and technology trends. Within each area, consideration is given to trends in both the common carrier and broadcast segments.

Examining each segment is important because a number of changes continue to show potential for affecting the way telecommunications services may be delivered in the future.

1. General Business Trends

Within the common carrier group, more than 90% of revenues are derived from regulated services. Consequently, regulatory considerations will continue to be a strong influence on the direction and rate of growth.

Although the process of deregulation resulted in considerable confusion among service users and vendors, the initial, fundamental problems have been resolved. A number of significant business trends are apparent. INPUT expects the trends noted in Exhibit II-1 to affect the common carrier segment of the industry for at least the next several years.

EXHIBIT II-1

Key Business Trends
Common Carrier Segment

- Changing regulatory environment
- Globalization of industries
- Downsizing/consolidations
- Basic service diversification
- Emerging competition

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a. Changing Regulatory Environment

Though the BOCs continue to be constrained by the effects of the Modified Final Judgment (MFJ), a significant shift in regulation now allows BOCs the potential to provide a variety of information services. However, this "potential" is being reviewed in Congress and may result in certain limitations. Most assuredly, the limits of deregulation will continue to be tested over the next five years.

INPUT believes that the BOCs will soon be competing in an open market with others in the intra-LATA toll arena. They will, however, continue to face strong opposition to manufacturing and to providing inter-LATA and long-distance services.

Newspaper publishers have also felt the effects of this deregulation. Telephone companies are now allowed to compete with publishers in providing information services such as electronic classified advertising and 900-service phone numbers providing information on stocks and sports.

b. Globalization of Industries

Slowing domestic growth coupled with international positioning has resulted in many carriers' expanding into new international markets. Target alliance markets include the European Community and countries such as the Ukraine, which were formerly part of the Soviet Union. Also, American carriers are now significant participants in the PTT privatization efforts of New Zealand and Argentina.

c. Downsizing and Consolidations

As a result of the weakened economy, regulatory constraint, and competitive need, common carriers are under significant pressure to downsize and streamline their operations. Plans are in place in most RBOCs and major independents to reduce the number of employees considerably. Companies continue to reorganize, lower operating costs, become more efficient, and enhance quality.

d. Basic Service Diversification

As technology enhances the ability to deliver greater (switched network) bandwidth, the BOCs are now in an excellent position to provide enhanced services to businesses and homes. Technology advances will continue to provide opportunities to diversify services.

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A major objective of local carriers and cable TV companies is to fully distribute fiber optic technology out "to the curb." This is being called a "volume commercialization" of fiber technology supporting voice, data, and video in local networks. It will be a long-term and very expensive endeavor that may not be completed until 2015.

e. Emerging Competition

With the regulatory environment becoming more flexible, common carriers and large independents may find competition for voice- and data-related services emerging from the cable TV, cellular, and local access (bypass) carriers.

Re-regulation may only be an interim solution, as significant activities are under way to induce competition in the CATV arena. Bills have been introduced by both houses that would allow phone and CATV companies into each other's markets. The bills would also mandate that the U.S. be fully equipped with high-speed communications by the year 2015.

Several business trends, listed in Exhibit II-2, suggest that the cable TV industry could emerge as a competitive threat to the local telephone companies.

EXHIBIT II-2

Key Business Trends
Cable TV Industry

- Regulation likely
- Competition likely
- Market saturation/consolidation
- Untapped market potential
- Infrastructure investment

f. Regulation

Consumers believe they are being overcharged for cable TV because many municipalities permit only one provider. Pressure is mounting to re-establish regulations that will control cable TV rates. The government's cable TV price index rose to 53.4%, which is more than twice the 23.4% overall rise in consumer prices over the same five-year period. Cable companies have had the field virtually to themselves since 1986.

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Regulatory bills have been introduced by both houses that would let local governments regulate prices for basic cable TV services. They would also make it harder for cable operators to deny rival entities the use of programming that they own or control.

g. Market Saturation/Consolidation

Assuming that competition is not induced, indications are that the CATV industry is approaching saturation. The cable industry can provide basic (cable) service to over 90% of the homes with television sets. Of these, approximately 65% already have service. The industry enjoyed a growth rate of 20% to 25% per year in the early 1980s, but since then the rate has dropped to 6% to 8% per year.

Some have suggested that there will be a consolidation of communications companies for expanded distribution of products and services. Publishing companies could have significant interests in cable, broadcast, motion picture, and electronic information services. This would be countered by telephone companies that have holdings and/or alliances in publishing, cellular, and cable TV.

h. Untapped Market Potential

Although the consumer market for CATV may be approaching saturation, the business market is largely untapped. Few business services are provided by cable companies. Traditionally, the industry has focused on building an infrastructure to serve the home consumer. However, there are many areas in which service cannot currently be provided to business, and the same facilities that serve homes in large metropolitan areas (New York, Chicago, San Francisco, etc.) can also serve businesses in those areas.

i. Infrastructure Investment

The cable TV industry is continuing to invest aggressively in new (fiber optic) facilities. New facilities are being built almost exclusively with fiber optic cables, and industry data indicates that older facilities are being replaced with fiber optic cables at a rate of 15% per year. Though coaxial cable technology may have been a limiting factor in the past, use of fiber optic cables will result in increased ability to deliver quality, broadband, digital services within the next several years.

The probability that cross-fertilized competition will be introduced into the CATV (and local exchange carrier) markets is quite high. However, it is a highly political decision and will most likely not be resolved until 1993. As this scenario unfolds, INPUT expects CATV companies to become aggressively involved in the personal communications services (PCS) micro-cellular network industry.

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Three additional trends are of significance to common carriers:

- Mergers and acquisitions will continue, but the major efforts appear to be nearing an end. The most notable activity in this area is by Centel, which has announced its interest in being sold. This can be considered a significant change in product/market positioning. However, the overall number of mergers and acquisitions appears to be declining.

- Foreign investment will also continue to be a means of leveraging expertise. There has been a decided increase in foreign investment activity.

- Electronic data interchange (EDI) is continuing to be addressed as a means of supporting large customer billing operations. Development efforts continue, but significant change in billing is not expected until 1993.

2. Technology Trends

Technology trends contributing to industry growth are shown in Exhibit II-3. Though most are known technologies, their impact as growth enablers are only beginning to be felt.

EXHIBIT II-3

Key Technology Trends

- Broadband transmission
- Advanced Intelligent Network
- ISDN services
- Multimedia services
- Mobile communications
- Network management

Of all the technological changes, greater bandwidth and fiber optics are continuing to have the greatest impact on how services are delivered. Significant technologies include:

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a. Broadband Transmission

Bell Operating Companies are developing major fiber optic digital broadband systems that will enable them to support increasing demand for very high data throughputs. This buildup in throughput capacities will be necessary to support significant increases in switched data and image, including multimedia requirements. Anticipated data rates by the year 2000 will be 300 to 500 Megabits, and into the low Gigabit range by 2005.

The availability of significantly higher switched service bandwidth will provide an opportunity for BOCs to compete with alternative service (bypass) providers to meet metropolitan data networking needs. As they successfully demonstrate their ability to deliver metropolitan-area network (MAN) services, carriers will integrate MANs with LANs via the technologies noted.

Since deregulation, local carriers have lost as much as 30% of their local (data) service customers to *bypass* alternatives. It should also be noted that the actual market share of the alternate carrier (bypass) industry is less than .02% of the $90 billion local communications market. Local carriers offering high-speed data switching services should help curtail market erosion.

Key components of these high-capacity systems will include fiber optics, SONET with the SS7 signaling system, Asynchronous Transfer Mode (ATM), and the Advanced Intelligent Network (AIN). These components will become the building blocks of local carriers, enabling them to support all forms of networks, including broadband LANs, metropolitan-area networks, and broadband wide-area networks.

Fiber optics offers the highest throughput capacities with the best data integrity qualities. It is the best, least expensive medium available in today's technology to meet the upcoming demands for exceptionally large capacities. Two fiber optic strands can carry 32,000 simultaneous telephone calls.

SONET (Synchronous Optical Network) is a standard for handling optical signals consistently, so that service providers, vendors, and users work from one set of international reference standards. While the basic data rate is just above 51 Mbps, it can go up to 255 times that, or over 13 Gbps. It can easily support today's lesser data rates and offers significant benefits to systems integration and networking solutions.

Common-channel signaling, or Signaling System 7 (SS7) is a standardized method of routing switched "calls" via separate computer links between telco offices and works in conjunction with fiber optic systems. It is far more complex than the old "in-band" signaling method, but offers reduced

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call set-up times, advanced traffic management, and enhanced networking features. However, the complexity of its software has led to some significant downtime recently, which denotes the risks of highly advanced network control technology.

Supporting technologies include fiber distributed data interface (FDDI), which supports high-speed LANs operating at 100 Mbps and metropolitan-area networks (MANs) operating at 45 Mbps. Switched multimegabit data service (SMDS) is another important component supporting MAN requirements. Asynchronous transmission method (ATM) is a new high-speed switching transmission standard that uses frame or cell relay transfer methods. Broadband integrated services digital network (BISDN) and high-definition TV (HDTV) will also become an integral part of the very high-capacity applications. Three-dimensional TV (3DTV) will bring even greater demands for bandwidth toward the end of the 1990s.

b. Advanced Intelligent Network

The Advanced Intelligent Network (AIN) enables carriers to introduce intelligent network capabilities and produce new communications services. The AIN software specification (developed by Bellcore) allows carriers to rapidly reconfigure or create and deploy new network service offerings using equipment from a variety of vendors. AIN's intent is to allow users to gain greater control of their telephone company's network services. This is accomplished through adjunct processors that are designed to rapidly handle the implementation of new services. Currently, most of these services are focused on enhancing the switching capabilities of Centrex and cellular telephone subscribers.

c. ISDN Services

Based on the AIN approach, such terms as ISDN (Integrated Services Digital Network) will nearly disappear from the public lexicon within the next five years. Providers will begin to define service sets that require integrated digital technology, but will market *services*, not ISDN.

Services actually brought to the public will be market driven. Users will be able to define specific services necessary to meet their needs and pay for them on a service-by-service basis.

In addition, users will be able to define mixes of services to meet their needs, at costs commensurate with the services received. The need for customer-defined services will place significant demand on providers for flexible (intelligent) software.

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d. Multimedia Services

Multimedia services encompass all forms of media including audio, image, graphics, data and full motion video. Multimedia is a new application-oriented technology based on the multiple senses of human interaction and facilitated through computers and telecommunications to convey diverse types of information. Many of these interactive applications require large broadband transmission facilities. Also, a new fault-tolerant protocol, very large data base storage, and application interfaces are being developed.

e. Mobile Communications

Until the record increases in growth that occurred in 1991, mobile (cellular) communications had been slow in reaching market forecasts. However, it is becoming increasingly important in providing fax and data transmission services. Several companies have developed laptop computers that interface to, or are integral with, cellular telephones. Improved data capacity and integrity will result from cellular system conversions to digital technology.

The potential benefits of AIN will be associated less with a place than with a person. AIN will determine where the call should be directed and what services will be available to the user. The common-channel signaling abilities of SS7 were designed primarily for land-line systems. As a result, there may be reduced potential for some of these advanced features.

Personal communications service (PCS), a micro-cellular technology, may represent a form of competition to the cellular industry and could appear as early as 1994. Although the government has agreed to free up 200 Megahertz of radio spectrum, the FCC must settle on a specific frequency band and technological standards. (Temporary frequencies have been assigned in the interim to allow for development and testing of concepts.) In addition, start-up costs for this new technology will be very high because of the increased number of cell sites per given area.

f. Network Management

With the implications of competition and the ever-increasing complexity of networks, the BOCs will increase in their participation in network management. The BOCs will be more responsive to customer needs and offer more information about the cost effectiveness, design, and operation of their networks.

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However, for the BOCs to become accepted as network managers, they must provide significantly enhanced network management tools. There are indications that some BOCs are beginning to broaden their skills in this area. Alliances are now being formed with other network management vendors who will provide help desk software and diagnostic/management software that is integrated into a BOCs products.

Although the previous points are oriented toward the common carrier segment of the industry, technology changes will also have an impact on the broadcast segment, particularly the cable TV industry. The two most notable technological advances are the growth of fiber optics and the availability of greater bandwidth.

- Fiber optics will provide a means of delivering a broader range of services than can be delivered today. With a fiber optic infrastructure, cable companies will be able to integrate one-way (broadcast) services with two-way (interactive) services. The ability to integrate one-way and two-way services will support major new market opportunities including voice, data, and multimedia services.

- With greater bandwidth available, broadcasters will be able to provide a wider range of services directly to business and the home. Some of these services will support high-definition TV (HDTV), subsequent development of three-dimensional TV, and multimedia systems—all requiring exceptionally large bandwidths.

- It should also be noted that the cable TV companies will need to make significant investments in switching technology and software to support the operation, maintenance, and billing requirements of these devices.

B
Issues and Events

1. Key Issues

There are several significant issues facing users and providers of (common carrier) telecommunications services. For vendors of information services to this industry segment, knowledge of the issues is necessary to understand how the industry will evolve over the next several years.

Companies continue to be concerned about the availability and cost of services; they have mounting concerns about the process of control and management of increasingly complex networks. Many companies consider the regulatory environment to be a shield that carriers use to avoid having to address users' needs. They also consider LATA boundaries to be artificial barriers that prevent them from receiving quality services.

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Customer questions and concerns form the basis for significant issues that face the common carrier segment of the telecommunications industry. Key issues are shown in Exhibit II-4 and are discussed below.

EXHIBIT II-4

Key Industry Issues

- Changing regulatory environment
- Local competition
- Foreign competition
- Service pricing
- Customer service

a. Changing Regulatory Environment

Regulations imposed by the Modified Final Judgment (MFJ) continue to be a significant consideration for telecommunications service providers.

The change in regulatory position allows the BOCs to offer information services. This action removes a primary restriction and allows them to use their installed base (imbedded circuits and switches) to provide information services. Telephone companies will now be able to leverage underutilized technology to deliver value-added services and reduce the cost of basic services.

However, there is some question as to how well the recent deregulatory ruling will hold up to congressional adjustments. Efforts are under way to shift the administration of the MFJ to either the FCC or the Justice Department. The MFJ Codification bill, as it is called, would pose a major threat to the BOCs' ongoing efforts to deregulate and would continue to prohibit manufacturing and long-distance services. The bill is supported by a coalition of long-distance companies, newspaper publishers, and consumer and communications labor groups.

With the granting of permission to provide gateways and information processing, questions regarding *inter*-area services continue to arise. BOCs have indicated that some business services, such as E-mail and EDI, will not be as cost effective if the service cannot be provided directly to a wide geographic (inter-LATA) area.

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b. Competition

Compounding the difficulties of the carriers on one hand, and stimulating them to be more aggressive on the other, is the very likely emergence of direct competitors. The primary focus of recent regulatory activities will be to open up local exchanges to competition and to remove hidden local phone subsidies.

Over the next several years, cable companies will become a significant competitive threat. As these companies change their networks from coaxial to fiber, they will develop excess capacity, capable of supporting local telephone markets.

As a reciprocal action, local telephone companies will be allowed to compete in the CATV industry. Some see this as a move to placate public disapproval of expensive CATV rates by "re-regulating" the industry with competition.

INPUT expects local telephone, cable TV, alternate access, VSAT, VAN, cellular, and PCS companies to be allowed to utilize their excess capacity and technology to provide a broader base of services in direct competition with each other. New strategic alliances will challenge many of the current ways of doing business in this arena. Intra-LATA activity could occur as soon as 1993; inter-LATA might not occur until 1994.

c. Foreign Competition

An issue of continuing concern for many telecommunications service providers is the degree of competition from foreign providers. However, the ability of U.S. providers to penetrate foreign markets is improving.

Since deregulation, service providers have noted an increasing share of their markets going to foreign companies. While the RBOCs and major independent companies (Sprint, MCI, etc.) continue to be the major providers to U.S. companies, end users are becoming increasingly interested in foreign companies as service providers. This reduces the market size for U.S. companies.

d. Service Pricing

The pricing of services has been an issue since the inception of deregulation and is expected to remain an issue for some time.

Efforts are under way to encourage state and local governments to deregulate their local telephone exchanges in preparation for the competitive actions previously noted. These efforts will identify the intra- and inter-LATA telephone rate subsidies that are currently in place. Subsequently,

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allocations would be redistributed to reflect a more realistic and competitive pricing structure. Some have suggested that the elimination of those subsidies would make the cost of a long-distance call comparable to a local one. The economic growth of enhanced services associated with these cost changes could be dramatic.

e. Customer Service

Carriers continue their transition from thinking of themselves as a utility to thinking of themselves as a competitive business in a total quality environment. Customers are still voicing their displeasure with unresponsive carriers. Carriers are focusing more attention on their customers' needs to integrate and manage complex network services. Efforts to provide network management products and services, such as the Advanced Intelligent Network, continue.

Given the combination of competition and price caps that direct BOCs to focus on cost reduction, questions are being raised regarding the potential for lower quality service. The current price cap strategy may become counterproductive.

2. Major Events

In this rapidly changing industry, there have been numerous significant events, such as rapid technology developments and mergers and acquisitions.

Exhibit II-5 summarizes a number of events that INPUT believes were significant, not because they received a great deal of attention in trade publications, but because they indicate industry trends.

EXHIBIT II-5

Major Events

- BOC information services
- CATV/LEC competition
- Personal communications services
- Mergers and acquisitions

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a. BOC Information Services

The federal courts have lifted a stay that prohibited the Bell Operating Companies from providing content-based information services. The ban on phone companies' developing their own information services had been in effect since 1984. The BOCs can now own, generate, edit, and manipulate information.

b. CATV/LEC Competition

The FCC specified new rules that begin to re-regulate the cable TV industry. These rules will allow local governments to control about 60% of the U.S.'s cable TV systems. On the surface, this effort uses regulation to control an industry. However, it has opened the door to a competitive solution through cross-fertilized services between telephone and cable TV companies. Competition is cheaper than regulation from a government perspective.

c. Personal Communications Services

The next major growth concentration of the cellular industry is expected to be in the micro-cellular area called personal communications services. It remains to be seen if the cellular industry can avoid becoming a competitor.

Cable network providers have filed a very large number of applications to begin to test personal communications services (PCS). This is the first step in the cable industry's entrance into the telephone services market. This entry will help to establish a base for the cable industry to become a direct competitor of established common carriers.

d. Mergers and Acquisitions

Centel Corporation, a major player among independent telcos, has put itself up for sale. This strategy will allow it to have better control of the sale of its business units or the entire firm. It provides local phone service in seven states, manages 44 cellular markets in 14 states, and has minority interests in 32 metropolitan cellular systems. Consolidation of the 1,300 independents is expected to continue.

The cable TV company Tele-Communications Inc., the largest provider of CATV services, announced that it was acquiring almost half ownership in Teleport Communications Group, which operates fiber optic networks in 25 cities. The merger and acquisition alliances reflect the competitive direction of the industries. In a separate announcement, a new telephone has been developed that can communicate over the CATV network.

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Viewed individually, these events might not be considered particularly significant. Viewed collectively, they indicate several important points.

- Significant competition will result from reduced regulation and the cross-fertilization of CATV and local telephone companies.

- Progress is being made in high-speed broadband technology. Bringing fiber optics "to the curb" by competing, non-traditional network service providers will facilitate the arrival of many new applications.

INPUT believes that these advances are strong indicators of significant growth in data networking services. Problems will exist, but a broad range of services will become available at more economical prices.

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III

Information Systems Environment

A
Applications

Application requirements for the common carrier and broadcast segments of the telecommunications industry are considerably different. For this reason, each is addressed separately.

1. Common Carriers

Common carrier applications have traditionally been developed internally. Systems development staff at RBOCs and major IXCs and independents indicate that as much as 90% of their applications result from internal development. There are several reasons cited for the traditional emphasis on internal development by the major carriers.

- Few vendors have been able to provide application products suitable for the telecommunications industry. On the whole, users believe that their environment is far too complex for packaged applications.

- Few vendors understand the requirements of switching systems. Industry managers have believed that the high degree of integration needed between switch systems and support application systems necessitated a dedicated staff.

- Until deregulation, staff size was of limited importance. Because prices were based on the company's cost structure, there was little incentive to reduce overhead costs.

Local exchange carriers and smaller independents that operate their own systems have generally been more receptive to packaged solutions than the large carriers. Because in many areas local exchanges serve primarily residential customers, they do not have as great a need for large, complex applications.

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The large carriers also indicate that this situation has changed since deregulation. And now, with the pressing need to provide content-based information services and potential cable TV opportunity/competition, they will look more to outside providers for assistance. Several reasons are cited for the changes.

- Most large carriers have had to make substantial reductions in staff. In an increasingly competitive environment, significant increases in staff productivity have been mandatory as staff size has been reduced.

- The nature of systems has been changing. Although switching systems remain complex, requiring specialized expertise, there has been growing emphasis on applications that support basic operational systems. The shift toward digital technology has fostered greater ease of integration between switching and control systems and support systems. The process of developing customer support and sophisticated billing systems requires less industry expertise and more design and development knowledge.

- Systems are becoming more complex, requiring greater knowledge of business applications. Electronic mail (E-mail) and electronic data interchange (EDI) require an understanding of business interaction, not just telecommunications expertise. Unique (industry) expertise is important, but is growing less important relative to the need to understand how business operates.

- Though the systems staff of common carriers have extensive expertise in switch system requirements and technology, they are frequently no more knowledgeable about local-area networks and open systems architecture than companies in other business sectors.

Most IS managers indicate that they would acquire application products if they were available. However, they believe that the environment is sufficiently unique that few standardized products are likely to become available.

With the advent of new information service offerings and competition with cable TV operators, telephone companies will need to provide additional programs and systems that adequately support these applications. More specifically, they will need to support electronic publishing, electronic directory assistance, enhanced voice mail/messaging, and service order and billing programs to support interactive CATV.

However, given this significant change in direction, the majority of the expenditures will be for systems integration and professional services to develop the new, complex systems that will support the new services.

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Exhibit III-1 provides a summary of the categories of applications that IS managers in common carriers believe will be most critical over the next several years.

EXHIBIT III-1

Critical Future Applications

- Service orders
- Flexible billing/EDI
- Facility management
- Electronic imaging
- Network management/outsourcing
- Software-defined networks

Although there is consensus on the applications that will be critical over the next several years, the same managers note a number of issues that hinder their ability to successfully develop the applications.

a. Service Orders

Service order complexity will continue to grow as many new applications are introduced, resulting from deregulation and competition. At the time of deregulation, order and customer information systems were old and inadequate. Large and small carriers invested considerable time and money in developing systems that were at least accurate. Just prior to deregulation, many carriers still used manual files to assign telephone numbers.

Although minimum needs have generally been met, technology and users' demands have not stagnated. Customers using the Advanced Intelligent Network (AIN) will initiate services from a terminal or touch-tone phone. They will add service features, delete service features, and change service parameters (WATS, virtual network configuration, etc.) from remotely located devices. Though providing basic access to these services is not exceptionally difficult, integrating orders with operational systems and order tracking and billing systems is highly complex. In addition, security issues can be major impediments.

For software vendors and systems integrators, the problems are highly complex. In addition, specific customer requirements are generally not known. RBOCs are typically conservative in pursuing the development of highly integrated systems that provide dynamic changes to services, but all recognize the need for such change.

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The need for caution is understandable. At the same time that customer demand is growing, the technology is changing rapidly. Major investments in specific applications could be outdated quickly. Some applications could even be outdated before development is complete. Carriers have placed their emphasis on developing applications that permit greater control of their environment. To better manage these unknowns, certain carriers have merged their senior IS and network (switching and control) managers under one vice president of systems technology. This movement will help management retain focus on the big picture of developing highly flexible systems that are controllable and will not be outdated quickly.

Control problems can be observed in a number of major network failures that have recently occurred and were attributable to SS7 program modifications. Although the modification to the program had been tested in a simulated environment, it caused massive and sustained outages when installed in the field. It has been suggested that the SS7 network controls are many years ahead of their time; it is still very difficult to isolate, identify, and control problems within this new environment.

b. Flexible Billing/EDI

Customers are also demanding flexible billing. Statements that provide a summary followed by a listing of detailed calls are no longer adequate. This is evidenced by major carriers' recent announcements of tailored billing statements and development of electronic data interchange (EDI) 811 telephone billing standards.

As enhanced services such as the Advanced Intelligent Network, electronic mail, and enhanced voice messaging become more prevalent, customers will want analysis of service cost as part of their billing. But as with service order systems, the carriers do not have a firm understanding of exactly which features are needed or what charges, if any, should be applied. They are also concerned about the effect on their operations.

The electronic data interchange (EDI) telephone billing standard 811 should help in the uniform definition of the specifics to be exchanged between the telephone company and the customer. While many questions have not yet been answered, several carriers are currently testing these complex applications. It is expected that the EDI billing solution will be predominantly for the top 3% of a telephone company's customers, who have huge telephone bills.

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c. Facility Management

Facility management systems continue to be important, and enhanced systems are needed. Digital system facility maintenance is more difficult than old, manual systems because of the speed at which digital systems can change. Processes, and the accompanying information technology, are needed to control facility information quickly and easily.

d. Electronic Imaging

The need for electronic imaging/storage mediums is growing. The telecommunications industry is required to retain vast amounts of cost and facility information as well as copies of customer invoices.

e. Network Management/Outsourcing

Nearly all carriers are interested in providing network management services. Several interexchange and international carriers have created alliances between themselves to support customers on an outsourcing basis. (VANs and systems integrators are also developing this market.) These alliances are using shared technical staffing teams and new, smart software-based network management systems that run the customer's networks on either a remote or local basis.

f. Software-Defined Networks (SDN)

Large corporate customers have a need to modify their networks, sometimes frequently. Carriers providing virtual digital networks must be able to provide the means for customers to define and redefine the network structure through software. Carriers are developing this necessary software to permit customers to control their (carrier-provided) networks. Also, the Advanced Intelligent Network (AIN) should provide significant improvements to the end user.

2. Broadcast Services

Application requirements for broadcast service providers can be divided into two general groups.

- The requirements for network broadcasters and radio networks are predominantly internal. Federal requirements necessitate maintaining certain records of activities. Few requirements beyond maintaining legal records and developing programming schedules govern the activities of small operations such as local radio stations.

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The FCC recently enlarged the number of radio stations that can be owned by a single entity. As a result, it is expected that the large networks and the evolving radio broadcast station conglomerates will have similar application requirements.

The activities of large (network) operations require extensive systems to maintain financial records, perform market analysis, develop and maintain "feed" schedules, and maintain legal records.

In all these cases, the systems are predominantly internal; there is little interface with the public. Although applications may be necessary for maintaining control, they provide limited competitive advantage.

- In contrast, the cable industry application requirements are more analogous to common carriers than to the broadcast industry. Today's systems are needed to perform traditional account control and billing, collection, and scheduling functions.

  Applications are also needed to record requests and bill for pay-per-view programs. They are needed to schedule connection and maintenance activities.

  The cable TV industry is preparing for significant changes that come with competition and from two significantly different industries. Many of the applications previously noted in the common carrier and mobile telephone areas will soon apply to the cable TV industry.

  For example, Cable Data is preparing for this eventuality by participating in the European telephone (and CATV) billing markets. It recently received a fairly substantial contract from Cincinnati Bell Information Systems to perform billing activities for some of the domestic cellular telephone companies. Also, many CATV companies have received licenses from the FCC to carry PCS transmitting signals between microcells.

B
IS Issues

Issues facing the common carrier and cable television industries are becoming quite different now from those of the broadcast network industry. Because of the differences, each is addressed separately.

1. Common Carriers

There are a number of issues facing the information systems organizations of carriers and independent service providers. As shown in Exhibit III-2, many issues now relate to pending changes cause by new services and competition and organization.

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EXHIBIT III-2

Key IS Issues—Common Carriers

- Developing new services
- Allowable activities
- Decentralization
- New technologies
- Staff reductions

a. Developing New Services

- With the recent change in deregulation of content-based information services and the potential to compete in CATV markets, information service departments are confronted with many significant and complex issues. Some of the questions to be addressed are:
  - Will the new services be acquired outside or developed internally?
  - Organizationally, is it better to form new business units to perform these IS activities, or can the existing IS organization adequately develop and provide them?
  - What staffing capabilities already reside within the IS organization?
  - How fast should they move ahead in the development of the new service in light of the potential for new regulatory constraints?
  - Can the new services leverage existing computing resources?

INPUT believes that many of these development issues will be solved through acquisition and alliance with various private businesses that have already developed these key technologies. The first challenge for the carriers will be to adopt the best version of a given technology/service and successfully integrate it into a newly created business unit. The second challenge will be to successfully roll out the new technology/service as a lean and flexible, service-based entity, unencumbered by the large corporate parent.

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b. Allowable Activities

- The extent to which carriers are allowed to perform certain functions has a major impact on development approaches and priorities, particularly when considering regulatory and technological changes that may or may not be forthcoming.

  - BOCs are currently not permitted to provide service outside their defined service area (LATA). They therefore have little direct control over the quality of data received. Systems development times are extended due to the need to coordinate with multiple organizations for the passing of information. Extensive coordination and technology compromise are necessary to implement new services. Coordination and compromise both add time and cost.

  - As regulatory restrictions ease, many BOCs plan on being able to deliver services outside their immediate service areas. Decisions must be made about whether to incorporate future capabilities or to build more basic systems that must be changed at a later date. The latter will cause increased future costs for redesign requirements. The former causes higher short-term costs and risks exposure of future market strategies.

  - Although regulated carriers are now permitted to utilize their existing asset base to deliver enhanced information services, caution must still be exercised when planning to leverage existing applications. Utilizing an existing application as a basis for a new service may still be considered a form of subsidization, under certain circumstances. Information systems managers must exercise caution in systems development efforts where shared systems are involved.

c. Decentralization

Prior to deregulation, carriers were highly centralized with a primary focus on technology. Since deregulation, their focus has shifted to customer service and marketing. With the change, there is increasing decentralization, as responsibilities move closer to the customer. The decentralization creates needs for more sharing of data and flexible systems that are responsive to customer demands.

d. New Technologies

Many telecommunications providers are ill-prepared to successfully apply new technologies. With a background in voice and data services, many have little knowledge about local-area networking. Few have any background in electronic imaging. Although carriers have been enhancing their skills to include local-area networking, few have any greater knowledge than most other companies.

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e. Staff Reductions

Accompanying the current regulatory constraints and new technologies, most providers are still under pressure to reduce personnel costs. Productivity-enhancing tools provide some assistance in meeting commitments with reduced staffing, but do little to provide a foundation for addressing new technologies.

The issues are more pronounced among medium-sized and smaller providers. While the BOCs and IXCs assess strategic direction and prioritize major new applications, LECs must determine how to provide enhanced basic services with limited resources.

2. Broadcast Services

Key issues in broadcast services are more closely aligned with issues faced by IS organizations in other industries than with those of cable TV and common carriers.

Exhibit III-3 provides a summary of major issues.

EXHIBIT III-3

Key IS Issues—Broadcast Services

- Reduced operating margins
- Staff reductions
- Aging systems

- The state of the economy and shifting fortunes of programming ratings have had the effect of reducing operating margins. With the reduced margins and the need to invest in new program strategies, IS frequently is unable to make major investments in new applications.

- Reduced revenue/expense ratios have also caused some reductions in staff, further reducing the ability to implement new strategies.

- Coupled with reduced funding and organizations, systems are beginning to reach the end of their life cycles and need to be upgraded. However, because of the reduced funding, IS managers are having to make do with small changes rather than major initiatives.

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3. Cable Television

While major broadcast networks struggle with reductions in funding and staff sizes, the cable TV industry is struggling to keep up with an expanding customer base and the potential of several new services. As shown in Exhibit III-4, many issues now relate to pending changes due to new services, competition, and organization.

EXHIBIT III-4

Key IS Issues
Cable Television

- Developing new services
- Outsourced alternatives
- Rapid growth

a. Developing New Services

- With the recent changes in re-regulation and the potential to compete in PCS and subsequent local telephone markets, information service departments are confronted with many significant and complex issues. The most significant of the issues confronting IS organizations in CATV companies are identical to those faced by their future competitors, the local telephone companies. (See Section B1.) To reiterate, these issues are:

  - Will the new services be acquired outside or developed internally?

  - Organizationally, is it better to form new business units to perform these IS activities or can the existing IS organization adequately develop and provide them?

  - What staffing capabilities already reside within the IS organization?

  - How fast should they move ahead in the development of the new service in light of the potential for new regulatory constraints?

  - Can the new services leverage existing computing resources?

Again, INPUT believes that many of these development issues will be solved through acquisition and alliance with various private businesses that have already developed these key technologies. To a lesser extent, alliances will also be formed with local telephone companies.

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The first challenge of the CATV industry will be to adopt the best version of a given PCS and successfully integrate it into a newly created business unit. The second challenge will be to successfully roll out the new PCS as a lean and flexible, service-based entity, shedding its image of a price-gouging, utility-like entity.

Multimedia services will probably be developed concurrently with the PCS networks. The direct-cabled telephone business will be developed later, subject to congressional influences.

b. Outsourced Alternatives

In light of many existing applications, it is anticipated that systems integrators and industry-based service bureaus will be able to provide many of the needed programs and expertise.

c. Rapid Growth

- Cable TV operators, particularly the small ones, are, in many cases, struggling with small systems that frequently require extensive manual intervention. They have begun to exceed their ability to effectively manage the systems.
- Larger operators are placing increasing reliance on providers of comprehensive turnkey systems.

C
Impact of New Technologies

Exhibit III-5 summarizes the major impact of new technologies on nearly all common carriers.

EXHIBIT III-5

New Technology Impact
Common Carriers

- Decentralization
- Data/Systems integration
- Greater customer control
- System flexibility
- Increased information flow

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- Decentralization—As with many industries, information systems in common carriers are being decentralized. Decentralization is most prominent in the marketing and customer service departments. Marketing and service are assuming greater responsibility for defining and managing development requirements and projects.

- Data/Systems Integration—Organizational decentralization and the growing need for integration of data across functional areas are driving a need for the integration of systems. Data about customers and their service status must be available to operational and support departments.

- Customer Control—Customers recognize the value of digital technology and the value of many of the services that carriers are beginning to offer. Many customers have demonstrated increased interest in the use of many services such as software-defined networks, network management, and virtual digital networks.

  - Digital technology has created an ability for customers to directly control their networks and services. Customers look forward to the use of services like the AIN that will provide access to carrier systems to define networks and change features and functions.

  - Customer demands create significant pressure on the carrier information systems organization to develop processes that permit greater customer control of their services. Greater customer access results in greater concern about system security.

  - Meeting customer demands is fostering new technologies—such as expert systems and artificial intelligence—in which many carriers are gaining knowledge and expertise.

- System Flexibility—Large and small customers are demanding greater flexibility in defining services that will best meet their needs. Prior to digital technology and deregulation, carriers defined categories of services. Older technology did not permit great flexibility and carriers were not inclined to develop many options. Customers either accepted or declined to accept the defined service.

Today, customers want to be able to select specific services to meet their needs and to be able to change them quickly and easily. They want custom sets of features and custom-designed billing. They want to be able have analysis performed on both costs and service levels. As customer demand continues to exceed the ability of carrier information systems groups to develop systems, carriers are seeking alliances with outside vendors to meet these needs. Carriers are also beginning to play a major part in developing new standards for network management and EDI telephone billing.

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- Increased Information Flow—There is a seemingly never-ending demand for greater bandwidth to pass greater amounts of data. Coupling these data demands with the new requirements for huge amounts of bandwidth to support HD and 3D television and multimedia applications will drive capacity requirements to exceptional heights. From the introduction of the first wideband (T1) services ten years ago, carriers will soon be able to provide local- and metropolitan-area switched network services at speeds of 300-500 Mbps. These speeds are expected to pass well into the low Gigabit ranges by 2005.

The broadcast services segment of the telecommunications industry has not, until now, been significantly impacted by many of the technologies.

INPUT expects this to begin to change over the next few years. Exhibit III-6 highlights a number of impacts that new technologies will have on the broadcast segment of the telecommunications industry. Note that the majority of these will be in the cable industry.

EXHIBIT III-6

New Technology Impact
Broadcast Services

- Interactive service growth
- Increased networking
- Increased business applications

As noted earlier, the technologies that will have the greatest impact on the broadcast (primarily cable) industry will be fiber optics, digital technology, and micro-cellular PCS services. These will result in several secondary impacts.

- Interactive Service Growth—With the availability of increased bandwidth of fiber and digital technology, many of the limitations of coaxial cable will be overcome. The additional capacity of fiber coupled with the enhanced capabilities of digital technology will permit the introduction of new interactive services that have not been readily available in the past.

  - Cable companies will compete directly with BOCs and alternative service providers for the provision of local- and metropolitan-area telephone, PCS, and CATV services.

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- Cable companies will be able to provide direct connections to electronic information service providers that are of higher quality than those provided by many BOCs today.

- Increased Networking—With the introduction of PCS and telephone competition and a growing demand for CATV and multimedia interactive services, there will be a need for increased networking within the cable industry. Industrywide networking is limited today, but this will change.

- Increased Business Applications—There will also be a growing demand for business applications such as enhanced voice messaging, electronic directory, electronic mail, electronic data interchange, and electronic funds transfer.

Initial growth could be slow. There is currently no single organization promoting the use of networking applications and there is no single cable service provider that can meet the needs of the entire industry. This will change also.

Organizations such as Tele-Communications, Inc., Cincinnati Bell Information Systems, Cable Systems Group (part of American Express's Information Systems Group), and CableData are in key positions to be able to promote the growth of some of the network services in the cable industry.

D
Organization and Budget

In larger carriers, there are frequently at least two information systems organizations. One is dedicated to developing and managing the carrier's switching systems. This organization typically reports to an operations executive.

The second organization is typically responsible for the company's internal and support systems. This organization may report to a Chief Information Officer or similar position, not unlike IS departments in other companies.

The distinction is important to vendors, since the priorities of the organizations are considerably different. The *internal* organization is increasingly functionally oriented. Its interest is in receiving the best value, recognizing that systems may need to be changed sometime later. The *operations* organization is more interested in the technical detail. Switching systems must be extremely precise and change is difficult, with far-reaching implications.

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This distinction is now starting to blur as at least one of the BOCs has put both organizations under one senior manager. This is attributable to growing similarities in goals and objectives that support the combining of digital technologies, the need for rapid development/change of products and services, and responsive customer assistance.

Exhibit III-7 provides a summary of the distribution of the budget reported by internal information systems organizations. Overall, they reflect continued growth with external purchases showing a higher growth rate than internal expenses. Note that the purchased services category includes information services discussed in Chapter IV.

EXHIBIT III-7

Information Systems Budget Distribution

	1991 Percent of IS Budget	1991-1992 Percent of Expected Budget Growth
Personnel (Salary & Fringes)	33	4
Hardware	28	12
Purchased Services	39	16

- Personnel—The growth rate for personnel includes two factors—salary increases and staff reductions. Information systems managers indicate that there will continue to be reductions in staff, but the reductions will be significantly fewer than have been noted over the past several years.

  Major reductions in force are near an end; what remains is fine tuning. Many of the remaining reductions will be accomplished through attrition. The growth of personnel expenses reflects a net result of salary increases and expense reductions due to the attrition.

- Hardware—The overall increase in hardware expense is greater than in many industries. The growth is attributed to the need for bigger systems to accommodate more complex applications and larger data bases. Expansion in hardware also reflects a growing focus on workstations to carry out increasingly complex tasks.

- Purchased Services—Growth in purchased services includes software and services discussed in the following chapter. It also includes expenditures for voice and data communications services provided by other (non-value-added) carriers. The growth is attributable primarily to growth in professional and systems integration services.

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Within the broadcast services segment, the expenditure breakdown is more in line with that in other industries. Expenditures for personnel and hardware are a higher percentage of the total and external purchases are lower.

E
IS Department Objectives

Information systems managers continue to note several objectives that will be paramount in their plans for the next year. In general, they reflect the final stages of the evolution that began with deregulation and have been progressing for the past three years. Key objectives are summarized in Exhibit III-8 and discussed below.

EXHIBIT III-8

Information Systems Objectives

- Strategic/tactical planning
- Improve staff productivity
- Flexible billing
- Integrate operations systems
- Decentralize/distribute systems

- Strategic/Tactical Planning—Implementation of longer term tactical systems planning nears an end. Major fix-up efforts are nearly complete. Information systems organizations are now focusing their attention on the best approaches to deploying systems that will support/provide content-based information services and cable TV.

- Improved Staff Productivity—Pressure to increase the productivity of information systems staff continues. With major reductions in staff sizes reasonably complete, attention has shifted to identifying productivity-enhancing tools and procedures. Technology training has increased and productivity tools such as CASE and DBMSs are at the forefront of technology planning.

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- Flexible Billing—More flexible billing systems are needed, to respond to customer needs for customized billing. Systems are needed that will provide support statements that reflect a customer's way of doing business and provide analysis of costs. Customers need to be able to assess the cost of features and the cost of special tariff provisions.

- Integrated Operations Systems—There is a continuing need to integrate operational and support systems. Near-term efforts continue to be on integration of maintenance service systems with customer service and billing systems. With maintenance now a billable item, there is need to ensure service tracking and accurate billing. Cable management systems must also be integrated to support service and maintenance requests.

- Decentralized/Distributed Systems—Integrated systems must support customer service representatives who are increasingly decentralized into marketing departments. Marketing departments are increasingly in need of market profile data to target service offerings.

Over the past three years, the key word in most information systems organizations has been *survival*. Now the overall focus has shifted to developing systems that will meet the competitive needs of the not-too-distant future.

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IV

Information Services Market

A
Overview

1. Market Overview

As noted in Chapter I, there are an estimated 22,000 providers of telecommunications services in the United States.

- Common carriers represent only 9% of the total providers, but two-thirds of the total expenditures for information services.

- Within the common carrier group, RBOCs and IXCs represent 80% of the industry's revenues and account for half of the industry's information services expenditures.

- Since approximately 90% of the industry's revenues are for the provision of regulated services, the majority of information services expenditures are to support regulated activities.

INPUT believes that the overall situation will begin to change within the next several years.

- Cable companies are beginning to provide network-based trunking systems supporting the new PCS micro-cellular networks. These PCS trunking systems, coupled with interactive (information) services, will open new opportunities for vendors and create pressures on the common carriers and independent service providers. Within the next few years, cable TV and alternate bypass carriers will provide local telephone services and will be in direct competition with local access telephone companies.

- The regulatory environment is changing for both telephone carriers and cable TV operators. Telephone companies are now allowed to offer content-based information services, which include numerous application possibilities. Cable TV companies are being re-regulated through the

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FCC and Congress. However, the most likely "regulation" will be the inducing of cross-market competition between the cable operators and the telephone companies. These actions will result in greater emphasis on the provision of enhanced information services by both organizations. Also, there will be an increasing need for network switching systems provided by CATV and bypass organizations.

- Because of these changes, the revenue mix will begin to change, as will the mix of expenditures for information services.

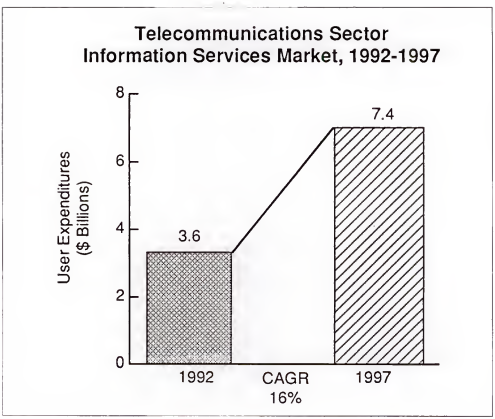
2. Market Summary

Until recently, information services expenditures have been directed primarily at gaining control of the communications environment and increasing productivity.

Though considerable investments have been made in new (nonregulated) activities, significant improvements have also been made in productivity and cost effectiveness. After a number of years of considerable struggle, the industry has achieved a momentary level of stability.

Overall, the market for information services in the telecommunications industry will grow at a compound annual growth rate of 16% over the next five years, from $3.6 billion in 1992 to $7.4 billion in 1997, as shown in Exhibit IV-1.

EXHIBIT IV-1



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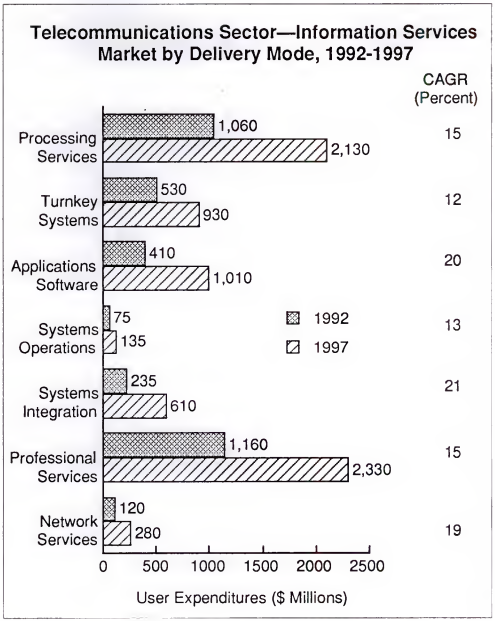
The market, broken down by delivery mode, is shown in Exhibit IV-2. Each delivery mode is discussed in the next section.

EXHIBIT IV-2



The overall telecommunications sector growth has been adjusted downward by approximately 9% to allow for the economic slowdown occurring in 1990 and 1991. In keeping with these adjustments, INPUT believes that the expansion rates of the delivery modes will now progress at the previously forecasted rates.

In terms of revenue, two delivery modes clearly lead the telecommunications sector—processing and professional services.

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Processing services are needed to support the numerous smaller carriers that are too large to be able to meet their needs with workstations and PCs and too small to have large information systems organizations. In addition, processing services are used extensively in the cable industry.

Professional services are also in great demand to assist large organizations in identifying, planning, and developing major new systems. Vendors that have experience in developing large, complex, integrated systems will find a ready market as carriers and cable TV companies develop comprehensive new systems capabilities. Growth in systems integration will complement professional services, as larger carriers and CATV companies invest in new technologies to support new information services, electronic imaging systems, and network switching devices.

Systems operations is expected to remain comparatively small, because large carriers will not permit outsiders to have total responsibility for their core business systems. Unlike other businesses, where information systems are an anomaly, information systems are the primary business of common carriers.

B
Delivery Mode Analysis

1. Processing Services

The market for processing services (transaction processing) is expected to remain strong, growing at an annual rate of at least 15% for the next several years. The market is expected to grow from $1 billion in 1992 to over $2 billion by 1997, as shown in Exhibit IV-3.

Growth of processing services is expected to remain strong for several reasons.

- Implementation of digital technology by smaller providers (LECs) has lagged behind that of the RBOCs and IXCs, but modern switching and control equipment is being implemented at an increasing rate. With the new technology, smaller providers continue to be interested in offering levels of service comparable to those in major metropolitan areas. The cellular, PCS, and CATV industries will also implement this digital technology.

- Smaller providers in both the common carrier and broadcast segments of the industry do not have the financial strength to make major investments in customer systems. They are reliant on service providers such as EDS, CableData, GEIS, and CBIS to meet their processing needs.

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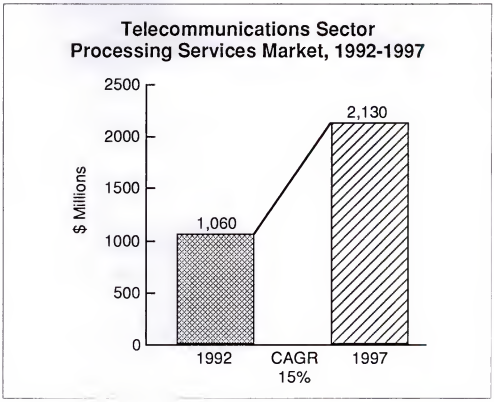
EXHIBIT IV-3



- As new technology is implemented, maintaining plant and equipment records becomes increasingly complex. Records that could be maintained manually ten to fifteen years ago must now be maintained by sophisticated systems. Although many of the smallest providers are making greater use of PCs and workstations to maintain records, many providers are outgrowing the capability of desktop systems.

- Likewise, as the cable, cellular and PCS industries expand, the need for complex customer and service support systems becomes more important. Many smaller providers are unable to make the necessary investments in large, complex systems.

2. Turnkey Systems

The market for turnkey systems is expected to continue to grow at a somewhat faster rate in the telecommunications sector than in the information services industry as a whole.

As shown in Exhibit IV-4, turnkey market subsectors will grow at compound annual rates ranging from 10% to 18% for the next several years. Between 1992 and 1997, the market will grow from $530 million to $930 million.

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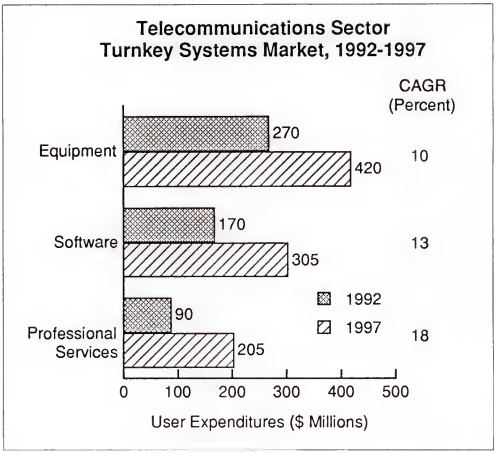
EXHIBIT IV-4



- The growth of turnkey systems results from the need for an increasing number of application-driven services such as voice messaging, E-mail, and EDI, and the need for universal gateways that are operated as standalone systems.

- The need for turnkey systems arises from several factors.

  - First, there is a reluctance on the part of carriers to incorporate information service-related functions directly into switching systems. Information service applications are frequently changed to make enhancements and corrections. Carriers do not want the changes made to applications to affect their basic delivery systems.

  - The second reason, in the common carrier segment, is equally important. Regulations prohibit the co-mingling of funds or assets. Carriers must maintain clear distinctions between assets and funds used to support the delivery of basic (telephone and circuit) services, and those employed to provide information services. Incorporating applications directly into the core infrastructure could be viewed as subsidization of information services by the basic systems. The risk of regulatory challenge is unwarranted.

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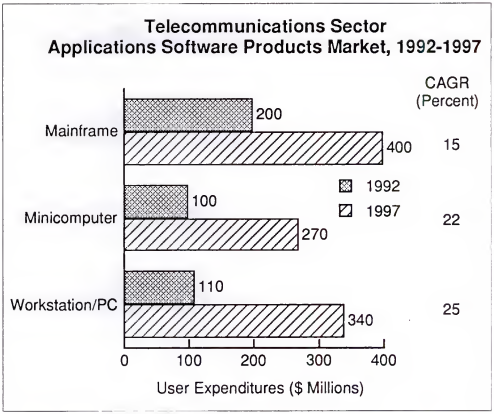
- In the cable industry, turnkey systems are becoming increasingly important. With the exception of the largest providers, developing large complex systems to maintain accounts exceeds the ability of many providers. Turnkey systems will become increasingly important as the cable industry begins to broaden its services. For many cable service providers, turnkey systems will be the only viable method of obtaining cost-effective systems.

3. Applications Software Products

The market for applications software will remain strong, growing from $410 million in 1992 to an estimated $1 billion by 1997—a compound annual growth rate of 20%, as shown in Exhibit IV-5.

EXHIBIT IV-5



The demand for applications software is being driven by the need for minicomputer and PC/workstation software. However, there is growing demand for mainframe software—in at least two critical areas—that will become more pronounced over the next several years.

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- Workstation/PC software is needed to support logistics and maintenance activities. Engineers need to be able to access central systems to obtain cable and circuit diagrams and obtain information about numbering assignments. Customer service and maintenance representatives also need to obtain information about the status of a customer's services. Workstations and PCs are being used more often to reduce the volumes of paper previously associated with service and work orders.

- The need to support imaging and mainframe-based artificial intelligence systems will contribute to significant growth over the next several years. These applications are only beginning to emerge, as carriers acquire increasingly sophisticated billing and customer support systems.

4. Systems Operations

The systems operations market is comprised of two elements: platform operations and applications operations. Platform operations refers to the management of an organization's computing hardware. Applications operations refers to the management of an organization's hardware *and* operational applications.

The market for systems operations in the telecommunications sector is expected to grow from $75 million in 1992 to an estimated $135 million in 1997, at a compound annual growth rate of 13%.

- Platform operations represents the largest portion of the systems operations market, but this has begun to change. The majority of systems operations services are provided to carriers that are too small to support large data center operations and too large to manage their business on workstations and PCs. Services are provided through direct links to major providers of operations services.

- As applications become more complex, an increasing portion of systems operations will include the management of applications that support business functions.

- Exhibit IV-6 shows that platform operations are expected to grow nominally, while applications operations grow at a significantly higher rate over the next five years.

- Note that systems operations are confined primarily to small and medium-sized common carriers and medium-sized cable operators. For large carriers (BOCs and IXCs), systems operations are an integral part of their service base. Unlike other industries, where information systems are an anomaly to their business, information services are the business of common carriers. The large providers are less likely to contract with a vendor to provide service that is central to their business.

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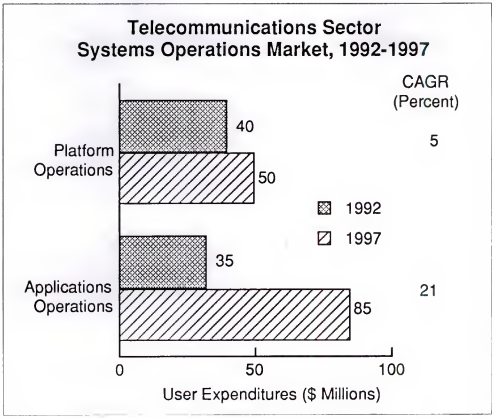
EXHIBIT IV-6



5. Systems Integration

Systems integration services currently represent approximately 6% of the sector, as shown in Exhibit IV-7. This percentage is expected to increase to 8% by 1997, due to a growth rate of 21% over the next five years. There are several reasons for the growth.

- Since deregulation, carriers have devoted extensive resources to enhancing their primary applications software. The billing and customer service systems that they inherited functioned poorly and were not able to meet changing needs. The majority of these systems have been either enhanced or replaced. However, the processes of integrating major systems and incorporating new areas such as EDI are just beginning.

- Customer service systems, containing profiles of a wide variety of features and services, must increasingly be linked to maintenance and network configuration systems. Charges for features must be integrated with charges for maintenance and troubleshooting.

- Systems must be integrated to be able to provide analysis of costs and network structure. Integrated systems are necessary for carriers to successfully provide network management services.

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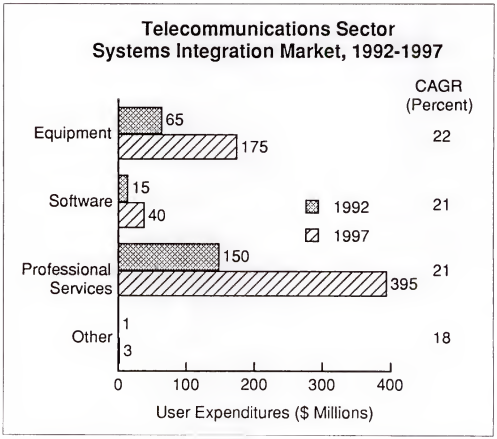
EXHIBIT IV-7



- In addition to the common carrier-based factors, there will be a growing need for integrated (network) service delivery systems to support the cable industry. The requirements are expected to begin to arise near the end of the forecast period.

- As the new content-based information services come on line and local carrier, cellular, and PCS areas develop, new customer service and billing systems—as well as enhancements to existing systems—will also be required.

6. Professional Services

Professional services represents one of the leading delivery modes in the telecommunications sector. There is a continuing need for both consulting and software development services to meet changing needs in a competitive market.

As shown in Exhibit IV-8, the professional services market is expected to grow at a compound annual growth rate of 15%, from $1.2 billion in 1992 to $2.3 billion by 1997. Systems development represents nearly 65% of this total.

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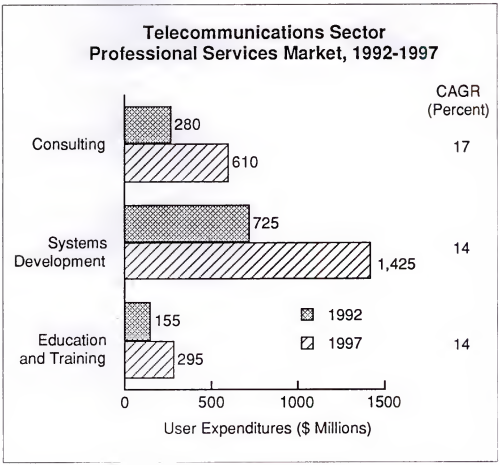
EXHIBIT IV-8



- As a result of severe reductions in staff and with the growing complexity of systems, carriers are turning increasingly to professional services to develop system specifications and perform system development. Professional services firms have a broader knowledge of application needs and requirements.

- In addition, use of professional services firms provides a means of training information systems staff in processes and procedures. Although many carriers have upgraded staff skills, information systems managers indicate that additional training is still needed.

- Use of professional services also reduces implementation time. As system criticality grows, due to the development of revenue producing services, reducing development time will be more critical.

7. Network Services

The market for network/electronic information services is expected to continue to grow, from $120 million in 1992 to an estimated $280 million by 1997 (see Exhibit IV-9). However, a number of changes are worthy of note:

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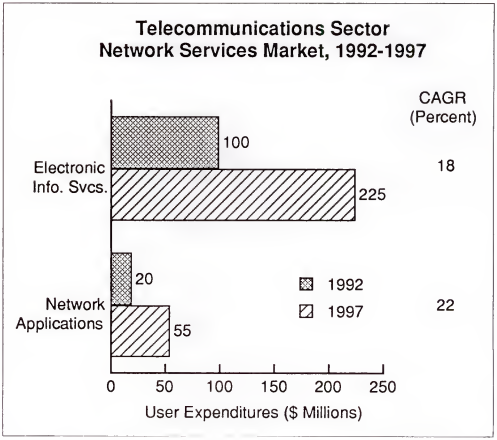
EXHIBIT IV-9



- Common carriers report that their need for internal electronic information services has declined over the past year or two, and the rate of growth is not expected to increase significantly. Although there has not been significant decline in their current expenditures, they do not expect the rate of growth to be as great as in the past.

- The primary reason for slowing growth is the weakening demand for the type of information provided by on-line services. Demand over the past few years has been primarily for econometric data and information about companies.

- Although it is the smaller portion of network services, network applications is expected to show strong growth as an increasing number of allowable services are identified. The market for network applications is expected to grow at an estimated 22% for at least the next several years. More importantly, the demand for network applications will increase significantly near the end of the five-year period. The demand will be driven by two factors.

  - With the expected entry of the cable industry into network services, there will be a growing need for PCS trunking and value-added network services such as voice mail, information processing, E-mail, EDI, and VAN services.

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- The cable industry will also seek to provide value-added network (VAN) services, particularly to companies in narrow geographic areas.

With the emergence of cable companies as competitors, common carriers will need to provide comparable services to their business customers. Growing competition for services provided to business will be an overall stimulus to the industry.

C
Industry Sector Analysis

1. Driving Forces

Major driving forces in the telecommunications industry are shown in Exhibit IV-10. Note that they are now beginning to focus on providing content-based information services and preparing for the potential challenges of cross-marketing local carrier and cable TV services. Need still exists to provide better internal support for changing organizations and to make better use of available resources.

EXHIBIT IV-10

Telecommunications Sector Driving Forces

- Deregulation
- Emerging competition
- Service/organization integration
- Flexible software
- Staff productivity
- Internal system support

- Deregulation has intensified pressure for competitive performance. This has become a baseline driver behind much of the shift to outside services, as a means of "catching up." All managers recognize that they could not have competed successfully with the systems and technology that they started with immediately following deregulation.

With the advent of content-based information services and the inevitable removal of cross-subsidization at the local level, managers will once again need to prepare for change.

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- The competitive environment is changing. The entry of the cable industry will create confusion and new demand. Confusion will result from new alliances and new ways of evaluating competitive positioning. Common carriers, which tend to be somewhat insulated today, will be faced with new competitive threats.

- New demand will result from the need of cable companies to provide a broad range of services and of common carriers to provide competitive services.

- With increased competition, customer-oriented services have become a necessity. Decentralization has moved staff closer to the customer. With this move, there continue to be needs to integrate service and support systems. Customers will not accept multiple points of contact. Marketing and customer service representatives must have access to companywide data about service and support. Because of this need, there is growing demand for open systems and integrated internal networks.

- There is an increasing demand for flexible software—such as AIN—which will be needed to support customers who want to be able to change service features immediately. Two- or even one-week delays are not acceptable. Business customers want to be able to change service features directly from their own premises, which creates additional demand for open system architectures and data base systems.

- A key to competitiveness is staff (information systems and user department) productivity. CASE tools contribute to productivity of information systems. Electronic imaging systems provide significant productivity advances to user departments.

- As in other industries, information systems executives in telecommunications are increasingly driven by user departments, as users respond to growing customer demands. The complexity of carrier systems has slowed the move of information systems into user departments, compared to other industries. But the move has begun, creating demand for systems to be deployed more quickly and cost effectively.

2. Inhibiting Factors

In addition to the driving forces, there are a number of factors inhibiting growth of information services in the telecommunications industry. Key factors are summarized in Exhibit IV-11.

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EXHIBIT IV-11

Telecommunications Sector Inhibiting Factors

- Regulatory contraints
- Unqualified customer needs
- Unresolved standards
- Continuing public pressure

- Though it is now possible to offer content-based information services, regulatory constraints on these common carriers continue to inhibit their activities. Certain factions in Congress, IXCs, and even movie and publishing concerns continue to seek constraints on local carriers to limit the type and amount of information services provided. Also, the BOCs still want to manufacture equipment and provide long-distance services.

- The needs stated by customers have generally not been qualified. The ability to make changes remotely to service features or network configuration is frequently cited by customers and information systems managers as a key market need. A few carriers have begun making investment in evaluating the real benefits of the Advanced Intelligent Network and the market potential of the services.

- Many standards affecting open system architectures, EDI, and radio spectrum for PCS are still unresolved. Many carriers and CATV companies are cautious about making major investments to provide these services until they are certain that standard changes will be minor.

- Consumer advocacy groups are continuing to pressure carriers to provide cheaper services. With the change from profit to price ceilings, public pressure could intensify if profit margins appear to be excessive, as interpreted by advocacy groups. The groups generally have little interest in new services, or the benefits of delivering the services. They are single-minded, focusing on the provision of cheap, basic service.

Overall, the driving forces significantly outweigh the inhibiting factors. Expenditures for information services will grow at a rate twice that of the industry as a whole. Emphasis is still on improving core systems that will provide greater opportunities for most vendors of information services, particularly those that provide processing and professional services. However, new markets and information services are also evolving into significance.

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V

Competitive Environment

With the change in regulation now allowing common carriers to offer content-based information services, many information services vendors are in the midst of presenting their latest technology to common carriers. Although it is still possible that Congress could create certain limitations on the type of services offered, carriers are establishing business units to evaluate, select, and negotiate with the most likely service-providing candidates.

Until the recent lifting of the regulatory restrictions, the BOCs had been concentrating on fixing antiquated systems, which precluded the rapid deployment of many new or planned services. Some of these carriers (BOCs) still need to spend considerable time, effort, and money to fix or redo their billing and customer service systems. Many of these systems will also need to incorporate EDI interfaces.

The developing need to provide these new information service offerings, coupled with the strong probability of competition with cable TV operators, should offer many excellent opportunities for vendors. They will need to provide many programs and systems that adequately support these applications. In addition to the new switching system requirements, carriers and CATV companies will need systems to support electronic publishing, electronic directory assistance, enhanced voice mail/messaging, and service order and billing programs to support interactive CATV and PCS services.

Systems integration, transaction processing, and professional services to develop and support these new, complex systems will be needed. For vendors, the need to focus on fixing problems will now shift to applying new, creative technology.

INPUT believes that the local access carriers (BOCs), bypass carriers, and cable TV companies are entering a new period of internal development and competition. These activities will require investment in new technologies and systems to support the new services.

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The extent to which common carrier and cable companies will provide significant competition to each other is still open to question. But their potential emergence as providers of comprehensive, network-based services opens many opportunities for vendors of information services.

Research on the providers of information services to the telecommunications sector leads to several conclusions:

- The leading vendors are providers of processing services and systems operations.
- Professional services are provided primarily to common carriers. Processing services are provided primarily to the broadcast (cable industry) segment of the sector.
- The largest vendors to the industry account for only an estimated 10%-12% of the sector's spending. The majority of the spending is with numerous smaller local and niche vendors.

A

Vendor Characteristics

A key characteristic of the telecommunications sector is that there are numerous providers of a wide range of information services. The majority provide service in only one, or at most two, delivery modes. With some 2,000 common carriers (LECs, IXCs, etc.) and 9,500 cable service providers located throughout the country, there are numerous local and regional information service providers to the telecommunications sector.

However, of the many providers, several derive significant revenue from services provided to the telecommunications industry.

Exhibit V-1 identifies the five leading vendors of information services to the telecommunications sector and the delivery modes from which they derive the majority of their revenues.

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EXHIBIT V-1

Leading Information Service Providers
Telecommunications Sector, 1991

Company	Delivery Mode
American Express/CSG	Proc. Svcs.
American Management Systems	Software, Prof. Svcs.
CableData	Proc. Svcs., Turnkey Sys.
Cincinnati Bell	Proc., Svcs., Sys. Int.
Electronic Data Systems	Sys. Ops., Sys. Int.

When considering the leading vendors, there are several points to note.

- INPUT's data excludes expenditures for switch system software. Switch system software is highly specialized, frequently delivered as part of a switching system, and is more analogous to embedded software than true systems or applications software. Providers of switch systems and software are not included in the vendor analysis.

- Bellcore is not included in INPUT's vendor analysis. Though Bellcore is an independent company, it is, effectively, owned by the Bell Operating Companies (BOCs). INPUT therefore considers its revenues to be captive revenues. Were it not for the captive nature of the revenues, Bellcore would be the largest information services vendor to the telecommunications industry.

- Revenues derived from the telecommunications sector are frequently only a small percentage of a company's revenues. With the exception of CableData, revenues for the leading vendors generally represent no more than 8%-10% and seldom exceed 15% of the company's (noncaptive) revenues.

With the exception of CableData and American Express's Cable Systems Group, which have established significant footholds in the turnkey systems and processing services markets (to the cable industry), services to the telecommunications sector are frequently an adjunct to a company's primary business, not its primary business.

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B

Leading and Emerging Vendors

The industry continues to be dominated by well-established vendors. As competition at the local exchange level becomes prevalent, these vendors will feel the pressure of new competitors. However, at least for the short term, leading vendor dominance is not expected to change.

Vendors such as AMS, CBIS, American Express, EDS, and GEIS continue to be leaders in applications and processing services to the common carrier segment of the industry.

CableData and American Express are the leaders in providing information services (primarily processing services) to the cable industry. Together, they hold an estimated 60%-70% of the market for information services to the cable industry.

However, the market is approaching transition and a number of changes are expected over the next several years.

- In general, the market is expanding and now includes local telephone, cable TV, alternate access, VSAT, VAN, cellular, and PCS companies. All of these are allowed to utilize their excess capacity and technology to provide a broader base of services in direct competition with each other—and at a local level. New strategic alliances will challenge many of the current ways of doing business and may also include publishing and movie producing concerns. These services will ultimately include intra- and inter-LATA activity.

- Many new vendors are currently presenting their new processing services to the highest bidder. Some of these new information services generate very high call volumes or bandwidths, requiring alliances with companies that are capable of providing significant switched network discounts.

- The cable industry is entering into network-based services. Cable companies are now significantly involved in testing PCSs (personal communications services).

- With more than 9,500 providers of local (cable) service, an extensive effort will be needed to develop and manage an integrated network. There is currently no integrated network supporting cable providers. Though there has been no need for such a network to date, there will be a need if the providers are going to successfully deliver applications such as E-mail and EDI.

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- Although American Express has little experience in the cable industry, it has extensive experience in managing networks and leveraging the value of networks to provide financial control and marketing. The Cable Systems Group could become a catalyst for developing industry networking.

- EDS' Personal Communications Corporation (PCC—originally Appex) is a large provider of billing services to the cellular, mobile, PCS, and satellite-based telephone industries. Operator Assistance Network (OAN) provides billing and collection services to common carriers. With EDS's expertise in managing networks, it could also become a major catalyst in developing a wide variety of network-based services for the cable industry.

- VANs and/or fiber optic carriers such as Wiltel are also potential providers of networking services for the cable industry. Alliances between an organization like CableData and one of the VANs or fiber carriers could result in an industrywide network within a very short time.

- Also, there are indications that CableData, Cable Systems Group (American Express), and EDS' Communications Industry Division are interested in providing an increased number of services (primarily processing services) to common carriers and CATV.

INPUT believes that the industry is changing. Over the next several years, there will be increased emphasis on network-based information services. Also, significant cross-market competition will develop between local exchange carriers, alternate bypass carriers, and cable TV companies. Processing services such as billing will continue to be valuable. Successful vendors will need to provide a wide variety of transaction and content-based information services.

Although there has not been a significant change of leaders in the telecommunications industry over the past few years, changes in the industry will alter the mix of competitors over the next several years.

Evolution of the industry, from a focus on basic services to value-added services supporting competing cable and local access carriers, will open opportunities for providing integrated products and network processing services that are not currently available.

An alliance between AT&T, U.S. West, and Tele-Communications Inc. (TCI) to conduct a test of integrated services suggests that perhaps the strange bedfellows of the past will be the partners of the future. TCI is the largest cable industry multiple service operator and recently became a primary owner of Teleport, an alternate bypass carrier.

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C
Vendor Profiles

1. American Express

AMEX's (American Express's) progress in penetrating the processing services market is not widely known. AMEX's experience in processing service dates back to the early 1960s when the number of American Express Card customers began to grow.

Since then, AMEX has branched out into other areas. It acquired First Data Resources to provide utility payment (credit card) processing services. It acquired a medical claims processing group and recently acquired a major interest in Cable Systems Group, the second largest provider of processing services to the cable industry. AMEX considers the cellular industry one that offers promising future growth.

In contrast to organizations such as EDS, AMEX's strategy has not traditionally been to provide contract (systems operations) services. Its strategy has been to acquire companies in which there is significant financial benefit in managing the flow of funds. Targeting an industry such as cellular suggests that AMEX's approach is not going to change. It may also suggest a greater interest in providing more services to the telecommunications industry.

The telecommunications industry is highly capital intensive and has extensive cash management requirements. Managing the flow of funds and having ready access to an exceptionally large customer base could fit well with AMEX's strategy.

American Express has a sophisticated network and extensive networking capability. It has the ability to provide sophisticated billing and collection services. It has been successful in leveraging its knowledge about customers into comprehensive marketing for related—and unrelated—services.

Either directly or through alliances, American Express could prove to be a strong competitor in the provision of transaction services to both common carriers and the cable industry. An added strength is that AMEX would not be considered a competitive threat to common carriers.

2. American Management Systems

American Management Systems (AMS) provides professional services, applications software and processing and micrographic services to a variety of industries.

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The federal government remains its largest market, but the company has been working to achieve a greater federal/commercial market balance over the past couple of years. The federal government still accounts for an estimated 21% of the company's revenues, but AMS has realized increasing revenues from the telecommunications industry. Telecommunications industry revenues are estimated to have been approximately 12% of the company's revenues in 1991.

The company's revenues are derived primarily from professional services. A key service has been the development of customer billing, message processing, service order management and carrier access billing. The services are provided to local companies, interexchange carriers, international carriers, electronic mail providers, and cellular telephone companies.

With IBM's 10% investment in AMS and AMS's continued focus on the telecommunications and financial services sectors, the company is expected to continue to grow significantly over the next several years.

3. CableData

Founded in 1965 to provide data processing and billing services to cable television companies in the Sacramento, California area, CableData has become the leading provider of subscriber management information and billing services to the cable industry.

CableData is actually the operating name used by U.S. Computer Services, the parent company of CableData. U.S. Computer Services is a private company that includes a number of operating entities. Its two primary subsidiaries are CableData and International Billing Services. However, as a result of a major stock buyout, the major shareholders are now the venture capital firms Weststar Capital and Enterprise Partners.

CableData is a well-known name and the name under which most services are marketed and managed. International Billing Services is an operating group that provides production billing services.

In addition to these services, CableLease provides lease financing for turnkey systems. CableData International provides services in Canada and other international locations.

CableData provides a complete system for managing a cable operator's account management and billing requirements. Systems can be operated as standalone systems or through service facilities in several locations around the country.

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Output from the systems can be sent or transmitted to CableData's International Billing Services (IBS) group, which will print and mail the statements. IBS also provides facilities for developing and mailing advertising.

In the early 1980s, the cable industry grew at rates that exceeded 25%-30% per year. Recent growth has been in the range of 6%-8% per year. Re-evaluation of this industry data suggests that a saturation point is not approaching and there is a strong possibility of increased sales due to expansion in existing and new markets.

CableData has recently reorganized and is expanding into new markets including telephone and cellular information billing services in Europe. To become more competitive in this market, CableData switched from Tandem to IBM computer platforms and developed a new UNIX operating system. It has supplanted its hardware maintenance staff with an outsourcing alternative. These actions suggest that CableData expects to take a leadership role in this industry that is in significant transition.

4. Cincinnati Bell Information Systems

Cincinnati Bell Information Systems (CBIS) was formed as an independent, unregulated subsidiary of Cincinnati Bell in 1983, as a result of deregulation. CBIS provides software products, and professional and processing services to telephone companies, large corporations, and the government. CBIS continues to provide products and services to foreign PTTs.

Key software products are related to customer billing, order entry, message processing, cable records, customer service, construction management, and cellular account management. Efforts are under way to render bills to customers through EDI. Products and services for the telecommunications sector are provided through CBIS's Telecommunications Information Systems business unit.

CBIS considers the telecommunications industry (both domestic and international) to be a strong niche for the company. However, it is placing increased emphasis on diversifying into non-telecommunications industry-related activities.

CBIS's focus on diversification is underscored by decisions to outsource some processing service activities previously done in-house. CBIS's focus on new industries has, until recently, included billing processing services for the cable industry. However, CBIS has recently outsourced processing activities to CableData, a major processing services company serving this industry. CBIS continues to provide processing services to cellular telephone companies.

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5. Electronic Data Systems

Founded in 1962, Electronic Data Systems (EDS) is a leading information and communications services company, providing information processing, consulting, systems management, systems integration, and communications services to a wide range of industries.

EDS currently has more than 60,000 employees and more than 7,000 clients in 50 states and 27 countries. EDS's largest client is General Motors and its subsidiaries. Services to General Motors accounted for approximately 55% of EDS's 1989 revenues. EDS operates 21 Information Processing Centers (IPCs) worldwide.

Telecommunications sector revenues represent a small portion of EDS's revenues. Although EDS has recently paid greater attention to identifying opportunities in the telecommunications sector, only an estimated 3% of its revenues are from telecommunications.

The EDS Communications Industry Division has approximately 3,000 employees and provides consulting, systems integration, systems development, systems management, and process management services to communications providers. It serves all telecommunications markets, including the motion picture and publishing industries.

It performs these services through four divisions. The Personal Communications Corporation (PCC) provides customer service, billing and network services to cellular, mobile, PCS, and satellite-based service companies. The Long Distance division or Operator Assistance Network (OAN) provides data processing, billing, and collection services to IXCs and other local service providers in the local exchange carrier industry. The Cable TV Service division performs billing, customer service, and subscriber management applications to cable operators worldwide. The Communications Industry division provides operational support systems to RBOCs and LECs in scheduling and network engineering.

EDS' business strategy shows exceptional foresight in its anticipation of changes in the systems operations market. EDS has expanded its penetration of current markets and is entering new markets. EDS's selection criteria for new markets include the size of companies in the sector, changes taking place in the sector, and how the changes will influence the receptivity of prospects to systems operations.

The telecommunications industry may offer EDS significant opportunity, at least in the longer term. In the short term, there are opportunities to assist with billing services to common carriers. In the longer term, EDS is in a key position to become a major provider of network-based services to both business and consumers.

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EDS's strength in providing network services results in EDS being perceived as a threat to many common carriers, particularly as the industry evolves to a broader base of integrated network services.

However, as a non-common carrier, EDS can add significant strength to LECs and independent carriers as an ally. Alliances can alleviate the perceived threat and establish EDS as a contributor to the delivery of integrated network services.

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VI

Conclusions and Recommendations

A

Industry and IS Market Conclusions

With the recent deregulation allowing BOCs to offer content-based information services, it appears that this highly regulated market is again undergoing some necessary and positive adjustments. Regulations have stifled creativity, and the necessity for companies to tread a fine line between competitive and regulated business offerings will continue to retard their deployment of new technology and services. However, it can also be argued that carriers may now be better prepared to operate in a competitive environment.

The competitive environment is beginning to change, also. The potential for cross-market competition between local exchange carriers, alternate bypass carriers, and cable television companies is very real. It is much more likely that Congress will place these separate entities into a competitive, "self regulating" environment, than that it will enact expensive laws to regulate and re-regulate these industries separately.

The demand for services, coupled with the growth of competition, will place strains on information systems departments. To respond to the needs, they will need to turn to information services vendors.

For information services vendors, the timing could be considered good. Increasing demand for new services and emerging competition will result in greater opportunities. Although there will be opportunities in nearly all the delivery modes, the greatest opportunities will still be in processing and professional services.

In the latter part of the five-year period, greater opportunities will emerge in competitive local network applications and systems and network integration. These will result from the abilities of Congress and federal, state, and local regulatory bodies to disentangle the remaining cross-subsidy issues between local and long-distance carriers.

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B

IS Vendor Issues and Recommendations

Exhibit VI-1 provides a number of recommendations for vendors entering or considering expansion into the telecommunications sector.

EXHIBIT VI-1

Vendor Recommendations

- Focus on integration
- Understand the carrier's customer
- Emphasize carrier-to-customer linkages
- Provide flexible software
- Develop network management tools
- Understand the regulations
- Learn the cable/local carrier industries

- Integrated systems will be the key to success for carriers within the next several years. For all but the smallest carriers (small LECs), who will turn increasingly to processors, the integration of service systems is mandatory. These must also be integrated with management control systems.

  Internal integration is also necessary as carriers progress with decentralization. Systems and services (LANs, E-mail, etc.) are necessary for effective communications between operating groups and functions that are no longer concentrated in one area.

- Vendors need to understand what the carriers' customers *really* want, not what they say they want. Frustration at lengthy service deployment has caused customers to demand more and more. Many recognize that they will only get a portion of what they want. Most are willing to pay for services that are valuable to them, but they will not commit to services until they understand the costs. Vendors that understand what a carrier's customers really want and what they are willing to pay are better able to sell software and software development services.

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- Linkages between carriers and their customers are becoming increasingly critical. Products and services based on accepted standards that permit users greater access to and control of networks are in increasing demand. Open systems and multiple-protocol support are among the leading needs, as evidenced by the success of value-added network carriers in marketing connectivity products and services.

- Software products that can be changed with moderate ease will replace complex, hard-coded systems. This will drive the demand for data base and parameter-driven systems that permit flexibility in defining features and options. In addition, systems such as SQL will be in increasing demand to meet changing management requirements.

- Carriers are placing growing emphasis on marketing virtual network services. But customers are still reluctant to permit carrier control without an ability to manage the network. Work must continue in building comprehensive network management tools that permit customers to have the visibility and control that are mandatory to the success of virtual network services.

- Understanding the regulations is critical to marketing success. Such understanding is necessary to respond to objections and to structure products that acknowledge the environment that currently exists and the changes that are pending.

- Within the next one to two years, cable companies and local exchange carriers will be providing local access carrier services to and performing information services for businesses as well as consumers. There will be a need for integrated applications and networks, with the focus being on information (data and multimedia) services. Given the new technologies and the demand for significant broadband services, the cable companies and local exchange carriers will need to quickly learn each other's industry to successfully compete in providing network-based applications.

The telecommunications market offers attractive opportunities, but vendors that market a wide variety of services may be at a disadvantage. Most successful vendors provide a product or service that addresses a specific need. The industry is highly specialized. Vendors need to be equally specialized.

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A

Definitions

Appendix A provides definitions of a number of frequently used terms related to the telecommunications industry.

- BOC (Bell Operating Company) - The regulated entity of the Regional Bell Operating Companies.
- Gateway - A method used by BOCs to provide access to unregulated services. The gateway provides a point of demarcation between regulated (basic) services and unregulated or value-added services.
- IEEE - Institute of Electrical and Electronics Engineers
- ISDN - Integrated Services Digital Network
- IXC (Inter-Exchange Carrier) - Service providers such as AT&T, MCI, and Sprint that provide basic long-distance service between LATAs.
- LATA (Local Access Transport Area) - Defined geographic area within which a Bell Operating Company is authorized to provide service.
- LEC (Local Exchange Carrier) - Regulated service provider to a local geographic area. May be a BOC or an independent service provider.
- MAN (Metropolitan-Area Network) - Local-area networking capability provided over a large metropolitan area.
- MFJ (Modified Final Judgement) - Court ruling providing basis for operating authority of regulated telecommunications service providers.
- RBOC (Regional Bell Operating Company) - Term used to describe regional providers of regulated and unregulated telecommunications services that were formerly part of AT&T.
- RHC (Regional Holding Company) - A regional provider of regulated and unregulated telecommunications services, formerly part of AT&T. Also referred to as RBOC.

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- SMDS (Switched Multimegabit Data Service) - Switched circuit service providing transmission speeds up to 150 Mbps.

- VSAT (Very Small Aperture Terminal) - Small satellite dish antenna (terminal), frequently measuring 3 to 4 feet in diameter.

For definitions of standard terms used by INPUT to analyze and forecast the information services industry, please refer to INPUT's *Definition Of Terms*. A copy should be found in the Market Analysis Program overview binder or clients may contact INPUT for a copy.

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B

Forecast Data Base and Reconciliation

Appendix B provides the forecast data base (Exhibit B-1) and a reconciliation of this year's forecast with the previous year's (Exhibit B-2).

EXHIBIT B-1

Telecommunications Sector
User Expenditure Forecast by Delivery Mode, 1991-1997

Delivery Modes	1991 ($ M)	Growth 91-92 (%)	1992 ($ M)	1993 ($ M)	1994 ($ M)	1995 ($ M)	1996 ($ M)	1997 ($ M)	CAGR 92-97 (%)
Sector Total	3,107	15	3,582	4,140	4,789	5,538	6,411	7,425	16
Processing Services	928	14	1,058	1,217	1,400	1,610	1,851	2,129	15
- Transaction Processing	928	14	1,058	1,217	1,400	1,610	1,851	2,129	15
Turnkey Systems	472	12	529	592	664	743	832	932	12
Applications Software Products	344	19	410	489	586	701	841	1,008	20
- Mainframe	174	15	200	230	265	304	350	402	15
- Minicomputer	82	22	100	122	149	182	222	270	22
- Workstation/PC	88	25	110	137	172	215	269	336	25
Systems Operations	65	12	73	83	94	106	120	135	13
Systems Integration	198	19	235	285	345	417	505	611	21
Professional Services	999	16	1,159	1,333	1,533	1,762	2,027	2,331	15
Network Services	101	17	118	141	167	199	235	279	19
- Electronic Info. Svcs.	83	17	97	115	135	160	188	222	18
- Network Applications	18	17	21	26	32	39	47	57	22

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EXHIBIT B-2

Telecommunications Sector
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 rpt (%)	91-96 CAGR per data 92 rpt (%)
	1991 Report (Fcst) ($ M)	1992 Report (Actual) ($ M)	Variance from 1991 Report ($ M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($ M)	1992 Report (Fcst) ($ M)	Variance from 1991 Report ($ M)	Variance from 1991 Report (%)		
Total Telecommunications Sector	3,413	3,107	-306	-9	7,106	6,411	-695	-10	16	16
Processing Services	1,020	928	-92	-9	2,052	1,851	-201	-10	15	15
Turnkey Systems	519	472	-47	-9	931	832	-99	-11	12	12
Applications Software Products	378	344	-34	-9	930	841	-89	-10	20	20
Systems Operations	71	65	-6	-8	133	120	-13	-10	13	13
Systems Integration	218	198	-20	-9	576	505	-71	-12	21	21
Professional Services	1,098	999	-99	-9	2,226	2,027	-199	-9	15	15
Network Services	110	101	-9	-8	258	235	-23	-9	19	18

There are several differences between the 1991 and 1992 forecasts that are of particular note.

- Although there have been no major changes in the overall size of the telecommunications sector, the industry was affected by the economic slowdown. An overall 9% decrease has been applied to 1991's forecast to compensate for the slowdown occurring in 1990 (-2%) and 1991 (-7%). Both forecasts had projected 15% growth in their respective years.

- This 9% adjustment brings the growth of information services in line with the 8% growth rate of the entire telecommunications sector.

- This slower growth rate is expected to return to 15% in 1992 and continue through the five-year forecast with a 16% CAGR. This resumption of more typical growth rates is supported by the advent of cross-market competition and deregulation of content-based information services, coupled with an apparent economic turnaround in an election year.

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INPUT provides planning information, analysis, and recommendations for the information technology industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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WHOLESALE DISTRIBUTION

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Information Services Market Analysis Program

Wholesale Distribution

Information Services Opportunities & Trends 1992-1997 Forecast Update

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MAAWD • 506 • 1993

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I

Objectives and Organization

This forecast update presents the 1992 INPUT forecasts for the use of information services personnel in the Wholesale Distribution vertical sector. A discussion of recent market issues and competitive factors that are influencing the use of information services in this vertical market is included.

A more comprehensive analysis of the wholesale distribution market and its components was presented in the 1991 report, which can be used as a reference when necessary.

In this analysis of the use of information services in the wholesale distribution market, the vertical market is defined as establishments in the following SIC groups:

- 5xx - General Wholesale SIC

- 501 - Motor Vehicles and Automotive Equipment
- 502 - Furniture
- 503 - Lumber and Construction
- 504 - Sporting Goods and Toys
- 505 - Metals and Minerals
- 506 - Electrical Goods
- 507 - Hardware, Plumbing, and Heating
- 508 - Machinery and Equipment
- 509 - Miscellaneous Durables

- 511 - Paper and Paper Products
- 512 - Drugs and Sundries
- 513 - Apparel, Piece Goods, and Notions
- 514 - Groceries and Related Products
- 515 - Farm Products
- 516 - Chemicals and Allied Products
- 517 - Petroleum and Petroleum Products
- 518 - Beer, Wine, and Other Distilled Beverages
- 519 - Miscellaneous Nondurables

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The objectives and organization of the report are described in this chapter. Other chapters of the report include the information described below:

- Chapter II details the trends, events, and issues of importance in the wholesale distribution sector, as well as factors that can have an impact on the use of information services in this market.

- Chapter III describes the Information Services market forecast for wholesale distribution in the U.S.

- Chapter IV provides a review of the competitive environment, including competitive events and vendor profiles.

- Appendix A refers the reader to INPUT's separate volume of industry definitions.

- Appendix B presents the Forecast Data Base, which contains a detailed forecast by delivery mode and submode for the wholesale distribution sector, and a reconciliation to last year's forecast.

Three additional vertical market reports should be referred to in relation to this Wholesale Distribution Sector Report:

- Retail Distribution
- Business Services
- Banking and Finance

A collection of all 15 INPUT market sector or industry reports and 7 cross-industry reports constitute INPUT's 1992 Market Analysis Program. Together, they provide a complete overview of the U.S. information services industry.

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II

Trends, Events and Issues

A
Environment and Market Changes

Three trends visible in wholesale distribution during 1992 were the increasing importance of distribution for manufacturers (one type of wholesale distribution), the rising use of information technology (IT) to support improvements in distribution, and a slight improvement in economic and business conditions that has signalled the beginning of a recovery.

- The increasing importance of distribution in manufacturing has been brought about by the need to improve services to clients and reduce costs and by the need to improve financial results. Distribution had taken a back seat in manufacturing while attention was given to mission-critical systems in MRP and accounting, but these systems have improved sufficiently to allow attention to service improvements that can be gained in distribution.

- The increasing use of IT to improve distribution is illustrated by the implementation of new warehousing and logistics IT application systems as well as by the growing use of networks to facilitate customer service and order entry, expanding use of electronic commerce, and more use of product coding to track goods and control ordering and stocking.

The increasing use of IT has been encouraged by greater use of client/server technology and downsizing, which have brought the ability to improve distribution to more customer service, warehouse, and other operational units.

The improvements in retail and manufacturing business in 1992 may not have been as substantial as desired, but they did result in an increase in wholesale business and signaled that the low level of sales that has plagued business during the last few years may be coming to an end.

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- The increase in retail sales in late 1992 provided a welcome relief to the weakness in retail distribution that had been prevalent during the last few years. Some jobbers and other firms serving the retail market have profited from the situation, although there are questions about the extent to which wholesale trade benefited.

- Improvements in manufacturing during the year had a definite, positive impact on wholesale business.

As was true for the last few years, 1992 performance results differed among the areas of the market being served.

- Wholesale distributors serving a number of retail industries, including apparel, shoes, appliances, furniture, and home construction supplies, continued to be affected by poor sales in these industries throughout most of the year. Sales picked up in most of these categories at year end.

- Wholesalers handling drugs and medical supplies or serving some areas of the electronics industry and the auto aftermarket continued to report better conditions.

The drop in retail inventories during last fall boded well for retail business and wholesale distribution, but the factor that has had a bigger impact on shipments of goods for retail trade in 1992 has been the force exerted by giant retailers such as Wal-mart and Target.

- The power of these giant retailers has been magnified by the fact that the high volume of retail orders that traditional department stores once generated fell sharply during the last five years, which impacted the business of wholesale distributors.

- In addition to telling manufacturers what goods to make, the giant retailers specify what should be shipped and when to ship it, according to *Business Week*.

A number of wholesalers have also reported a loss of customers as small construction firms or restaurants discontinued purchases and shipments from wholesale supply firms in favor of giant retailers or hyperstores, such as Home Depot, that serve wholesale and retail clients.

- These stores combine warehouse-like storage of items, a large inventory, and prices that are just as low or lower for these buyers than prices of the wholesalers they formerly used.

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- One chain of these giant stores serves anyone who pays a low fee to become a member. These stores are like warehouses with bulk amounts of food that are sold to restaurants and individuals and bulk amounts of office supplies and consumer goods that are sold to individuals and small businesses. This type of business can take sales away from smaller wholesalers.

The current business climate has continued to put pressure on the use of technology to change or upgrade key functions in distribution.

- In addition to warehousing and logistics, pressure is being felt to automate order entry transaction processing, supplying information on delivery status, picking and shipment of orders, and communication of information using electronic forms.

- Customers are also demanding more quality of service in terms of speed of response to inquiries and orders and quick delivery of goods that meet their specifications.

A summary of the key business issues identified by respondents from the wholesale distribution industry is shown in Exhibit II-1.

EXHIBIT II-1

Key Business Issues in The Wholesale Distribution Market

- Increased emphasis on manufacturing distribution
- Recovery in business in late 1992
- Schedules and needs of giant retailers
- Improvements in warehousing and logistics
- Expanding use of IT to support wholesale distribution
- Financing business changes and improvements

In order of importance to respondents

Wholesale distributors can be classified in several different ways:

- By the submarkets that they serve, such as apparel stores, hardware stores, or restaurants

- By size

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- They can be divided by whether they are independent wholesalers or part of a company that has manufacturing or retail components. Independent and captive wholesale units can be involved in distributing goods to retail establishments or to manufacturers or construction firms that will use the goods or materials that are received from wholesalers in other operations.

The needs for warehousing and logistics, as well as other systems, can be different based on the type of wholesaler, the goods or materials handled, and the customer involved.

About 5,400 to 5,500 large distributors handle 50% of wholesale sales.

- Most of these distributors have the resources to upgrade services to meet the strong competitive pressures that currently exist in the industry.

- A number of users have large on-line transaction processing (OLTP) systems operating on mainframes and/or minicomputers, but they have started to explore and use downsized systems on client/server technology.

The 29,000 to 30,000 mid-sized firms that handle 25% of wholesale business are experiencing more business difficulties and consolidation than the largest firms.

- Concerns of these firms are directed toward reducing costs as well as serving clients.

- These firms have started to explore and use workstation-based products.

About 265,000 smaller firms in wholesale distribution handle the remaining 25% of sales, and they are suffering most from the competition and unfavorable conditions that prevailed in retail distribution and manufacturing during the last few years.

- These firms rely on intensive clerical work by their owners and limited automation to keep costs down and serve their clients.

- Many of these firms have used processing services, as well as turnkey systems and software products from VARs, small vendors, and computer stores to meet their needs.

Wholesale firms were among the first users of processing services vendors.

- ADP and other processing firms continue to offer accounting and other application systems to meet the needs of wholesalers, although many of them have gone in-house.

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- Many wholesalers have turned from processing services to turnkey systems. Turnkey vendors, such as Imrex in the auto aftermarket (and other markets as well), Unisol in jewelry, and Eagle in food distribution, continue to appeal to distributors because they specialize in segments of the wholesale market. VARs also appeal to wholesalers for this reason.

A number of vendors, however, are promoting general-purpose approaches to wholesale functions that are gaining usage.

- The Lawson product, Wholesale Distributor, has powerful order entry and integrated accounting functions.

- The NCR Silver System has POS, integrated accounting, and remanufacturing management functions that are of interest to prospects.

Software and hardware vendors, including IBM, DEC, Unisys and Oracle, have addressed needs for increased on-line transaction processing capabilities (OLTP) for large, as well as smaller, wholesale distributors, as DEC has done for Kaman Corp.

Network capabilities have also been expanding to meet OLTP and other needs:

- A major tool maker obtains 65% of its orders via direct links to customers.

- A clothing manufacturer obtains on-line POS data from its customers to determine when reordering should take place.

- LANs in giant retailer outlets or megastores aid in handling information about product locations and inventories.

In order to meet network needs, Andersen Consulting has been offering an on-line order processing, inventory management, customer service, and DRP (distribution resource planning) capability for distributors called DCS/Logistics.

More comprehensive warehouse and logistics systems are needed by wholesalers to meet current client demands.

- Because manufacturers and retail outlets need to minimize the amount of inventory that they carry, but still obtain reorders rapidly, wholesalers need an efficient way to control warehouse and other steps involved in the motion of goods and materials to customers. A number of software vendors, including Computer Associates, are supplying new warehouse systems to meet these needs.

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- New warehouse and logistics systems, such as the systems offered by IM America, not only address just-in-time or other responsive types of needs, but they examine the accounting and financial implications of storage and other logistics functions.

Many systems offered in wholesale distribution, such as the DCS/Logistics systems mentioned above, are being or have been downsized.

- The Andersen DCS/Logistics system has been implemented on a workstation.

- American Software has moved its mainframe distribution product to a workstation running under MS-DOS. It will also be implemented under Windows and OS/2.

- J.D. Edwards has an OS/2 version of its distribution application system.

The midrange implementations of some distribution systems, such as the AS/400 version of the J.D. Edwards system, are still achieving more volume than the workstation versions.

- However, the workstation versions, particularly the RS/6000 version of the Lawson product, are gaining in use.

- The accounting system implemented on workstations by Macola, which is used widely in distribution, has also grown in use.

- Product information systems installed on RS/6000s and other workstations have also been sold to wholesale distributors.

The type of system mentioned above can be thought of as a step in electronic commerce because it allows buyers to bypass human assistance during an ordering process. Electronic commerce is gaining momentum in wholesale distribution activities.

- One element of electronic commerce, the use of EDI in ordering and settlement, has been growing due to the fact that large retail stores and manufacturers have encouraged or forced their wholesale suppliers to use it.

- The availability of electronic information on products to aid ordering by wholesalers is another example of electronic commerce.

The use of bar codes to manage inventory and parts delivery functions and the use of data from customers' POS units to monitor sales and reorder needs also illustrate how wholesalers are exploiting electronic commerce.

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A summary of key technology trends currently affecting the market that were mentioned by wholesalers and vendors is listed in Exhibit II-2.

EXHIBIT II-2

Key Technology Trends Identified by Vendors and Users in Wholesale Distribution

- The growth of general purpose capabilities versus industry oriented solutions
- Increasing automation of logistics and warehousing functions
- Expansion of network capabilities, including the use of LANs
- Downsizing of application solutions
- Expansion of electronic commerce

Technology trends mentioned by respondents

Vendors serving the wholesale market report that most sales require considerable effort and there is pressure to reduce the prices for solutions due to heavy competition.

B

Current Wholesale Distribution Events

Wholesalers felt increasing levels of pressure from retail giants in 1992.

- Wal-Mart, with about $55 billion in sales in 1992, has electronic linkages with all 5,000 of its suppliers. Some manufacturers have set up special distribution teams to meet these needs, particularly where retailers have bypassed wholesalers.

- Home Depot, which has rapidly reached an annual sales level of about $7.2 billion, requires all lumber suppliers to barcode each piece of wood delivered.

Large retailers and manufacturers now report that their suppliers have changed business methods, including warehousing, so that they can respond quickly to needs. Both retailers and manufacturers also report that they are attempting to improve the quality of suppliers in other ways, such as rapid replacement of defective units or parts.

There is a continuing expansion of network capabilities between wholesalers and their clients to expedite ordering, shipment instructions and other services. These capabilities have been promoted or facilitated by the clients in many situations lately.

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- Wal-Mart and Sears have developed means of providing their trading partners with inexpensive transmission services.

- J.C. Penney implemented a program in the last few years to increase the number of suppliers linked to its headquarters for EDI communication from 300 to 5,000.

Some large wholesalers, such as the large clothing manufacturer and wholesaler, Damon, have installed equipment at many of their retail clients so that they can track sales and expedite reordering for them.

The more intensive use of IT in wholesale distribution is illustrated by innovative applications of GIS (geographical information systems) during the last few years. One wholesaler uses a GIS to help plan the reassignment of sales territories. Another uses a GIS to create maps that indicate where client inventories are above or below plan.

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III

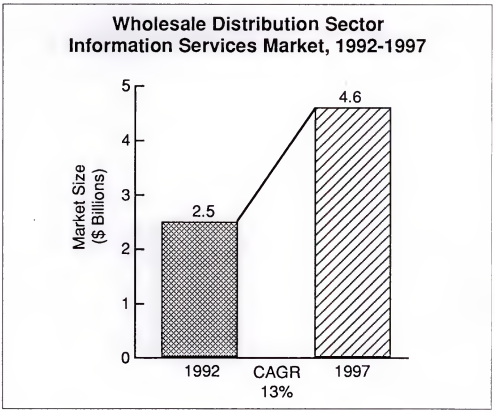
Information Services Market Forecast

A

Total Market Forecast

The growth of information services expenditures in the U.S. wholesale distribution sector between 1992 and 1997 is shown in Exhibit III-1.

EXHIBIT III-1



- Growth in this vertical market was held to a rate of 11% in 1991 due to the low level of business during the first three quarters of the year. Expenditures advanced from $2.3 billion in 1991 to about $2.5 billion in 1992

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- Between 1992 and 1997, demand for increased capabilities as well as increasing business will increase the growth rate to 13% CAGR (compound annual growth rate). Total expenditures in wholesale distribution will reach approximately $4.6 billion in 1997.

The demand for improved service from wholesalers, particularly in response to inquiries and requests for shipments, caused an increase of 4% in expenditures for information services in 1991 versus the forecast for 1991 made in 1990, and a forecast increase of 4% for 1996 expenditures versus the prior forecast.

Demand for increased IT capabilities together with improving business will result in a growth of expenditures for information services in wholesale distribution during the forecast period that will be above the forecasts for many other vertical markets, including business services, education, and banking. Forecasts for retail distribution and telecommunications indicate higher rates of growth.

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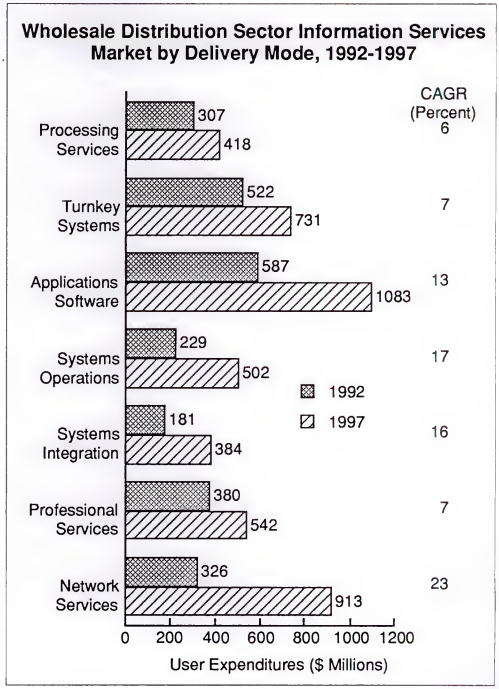
B

Forecast by Delivery Mode

The market forecast, summarized by delivery mode, is shown in Exhibit III-2.

EXHIBIT III-2



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1. Processing Services

User expenditures for processing services grew at a rate of 3% between 1991 and 1992, rising from $298 million to $307 million. They will grow at a compound annual growth rate of 6% for the next five years to reach $418 billion in 1997.

Processing services for wholesale distribution are growing at slower rates as the availability of downsized solutions increases. Processing services include accounting, mailing, order recording, and inventory work as well as systems for specific functions such as dealers in automobiles, tractors, boats, and planes. Many of the wholesalers using processing services are firms with few employees.

2. Turnkey Systems

Turnkey systems ranks as the second highest delivery mode for information services, behind application software products, in wholesale distribution, with expenditures of $487 million in 1991 and $522 million in 1992.

- The growth rate was 7% between 1991 and 1992 and will continue at that rate (7% CAGR) through 1997.

- Expenditures will reach a level of $731 million in 1997, which will make turnkey systems the third highest delivery mode in wholesale distribution.

The turnkey systems that Imrex provides in various wholesale markets and Global Turnkey provides in the wholesale electrical and building industry characterize the focus on submarkets that turnkeys have shown in wholesale distribution.

- The solution to an information systems need is provided from one vendor, who also may take care of maintenance, software support, and leasing. This is appealing to many small wholesale establishments where there is a small staff busily handling orders, inventory, and other functions.

- Turnkey systems provided by VARs have been attractive to wholesale and retail firms, but the trend by many smaller wholesalers during the last few years to buy workstation/PC products, application software products, and network capabilities through stores or equipment dealers has affected the volume of turnkey sales, according to vendors.

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3. Application Software Products

Sales of application software products grew at a rate of 11% during 1991 as expenditures for them increased from $527 million in 1991 to $587 million in 1992, making this the largest delivery mode in wholesale distribution. The previously forecast growth rate was also 11%.

- The growth rate of expenditures will increase to 13% for the period between 1992 to 1997, driven by a high rate of growth (23%) for workstation application software products.

- The growth of expenditures for workstation software products is generally in response to the needs of small and mid-sized wholesalers that were using manual or processing services solutions. There has also been an increasing tendency for these wholesalers to buy separate hardware and software products for a solution rather than to use turnkeys (see Turnkey Systems above).

Expenditures for application software products in the wholesale market will reach $1.08 billion in 1997, and it will continue to be the largest delivery mode in wholesale distribution.

4. Systems Operations

Growing at a rate of 19% in 1991, systems operations is the second fastest growing delivery mode in wholesale distribution.

- Expenditures increased from $193 million in 1991 to $229 million in 1992.

- Expenditures will grow at a compound annual growth rate of 17% between 1992 and 1997, advancing to $502 million in 1997.

Systems operations services in wholesale distribution include portions of outsourcing contracts for manufacturers involved with wholesale distribution functions as well as contracts with turnkey vendors to run or help with systems operation over a period of time longer than one year.

Systems operations and systems integration have the attraction of a single point of vendor responsibility that has been appealing to wholesale industry prospects in the past in relation to turnkey systems.

5. Systems Integration

Expenditures for systems integration will grow at a rate of 16%, from $156 million in 1991 to $181 million in 1992. Growth will continue at a compound annual growth rate of 16% through 1997, when expenditures reach $384 million. This is significantly less than the projected size of expenditures for systems integration in retail distribution, although the growth rate is high among other delivery modes in the wholesale market.

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The high rate of growth is based on the inclination of wholesale establishments to use or modify software products to generate a solution rather than to develop application systems from specifications. Systems integration is an alternative that will be explored, particularly for larger, more complex establishments that can not accommodate themselves to a turnkey approach.

6. Professional Services

The rate of growth for professional services in 1991 was only 1% above the 7% rate of growth in 1990.

- The growth rate of 8% resulted in an increase in expenditures for professional services from $351 million in 1991 to $380 million in 1992.

- During the forecast period, professional services will continue to grow at a compound annual growth rate of 7% and reach $542 million in 1997.

The low growth rate of professional services in wholesale and retail distribution compared to the growth rate in other industries is due to the preference for solution-oriented approaches: turnkey systems, application software products, systems integration, or systems operations that can use experience acquired elsewhere to help generate a solution more rapidly than full development might.

7. Network Services

Network services is the fastest growing delivery mode in the wholesale sector over the planning period.

- Expenditures for network services grew from $267 million in 1991 to $326 million in 1992 at a rate of 22%.

- Growth will continue at a rate of 23% through 1997 as expenditures for network services grow to $913 million.

The use of network services will be driven by the growth of network applications, including EDI/electronic commerce, electronic mail, and VAN's.

- Major stores such as Wal-mart, Sears, and J.C. Penney are insisting on the use of EDI by suppliers.

- Manufacturers and retail establishments expect wholesalers to use electronic means to send them information and notices of various kinds.

The use of network services is also due to the fact that wholesalers are major users of credit data bases and information on economic activity.

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IV

Competitive Environment

A

Recent Information Services Events

The benefits of electronic commerce were demonstrated by the growth of corporate trade payments to a level of $22 million in 1992. Many large stores and other corporations have put pressure on wholesalers to use electronic means of exchanging information.

A number of arrangements have been made between software vendors that have facilitated the expansion of electronic commerce. For instance, Sterling has formed alliances with Dun & Bradstreet Software, Walker Interactive Systems, American Software, and J.D. Edwards to link its EDI translation software to popular industry packages.

Another recent development in the wholesale market has been the downsizing of major software products used in distribution.

- American Software, Andersen Consulting, J.D. Edwards, and Lawson have all developed downsized products.
- GM has implemented a downsized distribution application on HP equipment.
- Motorola is moving its distribution systems to a downsized solution using open systems.

A number of new initiatives are being introduced in warehousing and logistics due to increased interest in this application area.

- The Swedish firm, Industri-Matematik, which has successfully introduced an expanded logistics system in Europe, started to market this system in the U.S. through a subsidiary in 1992.
- Computer Associates is preparing to release a new system called the Warehouse Boss.

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- Andersen Consulting introduced a workstation version of its on-line logistics and distribution system.

B
Vendor Profiles

The profiles of different types of information services vendors active in the wholesale distribution market are presented in this section. In order to illustrate the range of competition in this market, the strategies, background, and products and/or services of these vendors are reviewed.

Vendors are further differentiated by the fact that a number concentrate on business in specific submarkets, such as Triad in wholesale (and retail) auto supplies and hardgoods and Unisol in wholesale (and retail) jewelry. However, some vendors focus on one or more information services modes and address markets in which those modes are of interest, such as GEIS does with network services and American Software with application software products in wholesale distribution.

In addition to companies that are profiled, many other information services vendors serve the wholesale market, including IBM, NCR, DEC, ADP, Ultimate, Bull, GEIS, Ernst & Young, and CSC.

The following companies are profiled:

- American Software, Inc.
- Andersen Consulting
- BT Tymnet, Inc.
- Cambar Software, Inc.
- Dun & Bradstreet Software Services, Inc.
- Global Turnkey
- Sterling Software, Inc., EDI Group
- Triad Systems Corporation

Additional information about these companies or other companies active in wholesale distribution can be found in the VAP Program of INPUT.

1. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305 (404) 261-4381

a. Company Strategy

American Software has distribution software products that are now available on the AS/400 and MS-DOS workstations as well as on IBM mainframes. This allows American Software to offer products that will respond to the platform decisions of clients. Its distribution software product is composed of an integrated line of standard modules that were

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designed to run singly or in combination to meet unique customer requirements. These products have been supplemented to meet the needs of installations in particular industries, and American Software will perform professional services work to customize them to solve customer problems.

The modules of the wholesale distribution product of American Software include:

- Forecasting and inventory management software products that provide users with accurate sales forecasts to minimize and distribute investments in inventory
- Purchasing and materials control software products that provide information on the status of purchasing activities
- Financial and accounting software products

b. Company Background

American Software was founded in 1970. The company grew to over 750 full-time employees in 1990, and its calendar year revenues for 1992 reached about $115 million. The company provides both application software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation, and government clients.

c. Products and Services

Approximately 37% of revenues are provided by professional services to customize products and 13% from maintenance of software products. The amount of revenue from professional services amounts to about 50%. American Software is one of the most successful software vendors in marketing professional services.

The application software products that are sold can be divided into two groups:

- Forecasting and inventory management software account for about 8% of revenue.
- Purchasing, materials control, and financial software account for about 38% of revenue.

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2. Andersen Consulting, Arthur Andersen & Co.,
69 West Washington Street, Chicago, IL 60602 (312) 580-0033

a. Company Strategy

Andersen Consulting offers systems integration (SI), professional services, and software products for the wholesale distribution market. Andersen can discuss or demonstrate solutions to manufacturing and distribution problems as a means of appealing to and closing business with solution-oriented prospects. Andersen focuses more attention on manufacturing than on other markets, but has extended its capabilities to retail and wholesale distribution as well as to banking, utilities, and other markets.

Andersen emphasizes its knowledge of industries and applications, particularly in manufacturing and distribution, to make presentations and conduct consulting studies that can lead to large SI and professional services contracts. By studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings at companies that it contacts. The firm uses acquisitions and alliances to gain additional resources and knowledge to address its areas of interest.

b. Company Background

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its large, rapidly growing volume of information services business. Estimated worldwide revenues in 1991 for Andersen Consulting were $2.26 billion, making it one of the largest suppliers of information services.

c. Key Products and Services

About two-thirds of 1991 revenue was derived from SI. Approximately 25% was from professional services and most of the remainder from systems operation revenue. Revenue was also obtained from application and systems software products and network services. Some SI work involved customizing and installing in-house software products.

3. BT Tymnet, Inc. 2560 North First St., San Jose, CA 95131
(408) 922-0250

a. Company Strategy

BT Tymnet plans to be one of the world's largest providers of a wide range of shared, dedicated, and hybrid network solutions. The company operates the TYMNET public packet data communications network and provides access to dial-up services, major on-line data bases, EDI services, card authorization/electronic data capture, and related services.

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Actions have been taken to penetrate distribution, warehousing, and other industries where EDI business could grow.

b. Company Background

One of BT Tymnet's services, the TYMNET data network, was initiated in 1969 to support remote processing services to timesharing clients. In 1977, it became an FCC-regulated specialized common carrier, and it was acquired by McDonnell Douglas in 1984. In 1989, it was acquired by British Telecom plc together with a value-added service provider active in Japan. These acquisitions together with Dialcom, which was acquired in 1986, were organized as BT Tymnet, a subsidiary of British Telecom, in 1989.

c. Products and Services

The TYMNET network consists of intelligent communications processors and network capabilities that allow clients to communicate between attended or unattended terminals and their own or other computers in a variety of different locations. A number of different protocols, error correction, protocol conversion, data security, and other services are provided by the network. Access to major on-line data bases is also provided through this network.

EDI*Net is the principal EDI service of BT Tymnet, providing third-party, value-added communications services for automated exchange of business documents such as purchase orders, invoices, and bills of lading. There are over 1,000 clients, mostly in the transportation, grocery, electronics, telecommunications, aerospace, oil, and warehousing industries.

Credit card and electronic data capture are provided for all major credit cards as well as private-label programs.

Private and hybrid data networks are also provided to clients in a number of industries.

4. Cambar Software, Inc., 4975 La Cross Rd., Charleston, SC 29418 (803) 554-2970

a. Company Strategy

The company has developed and sold software products for wholesale distribution and manufacturing companies that support customer order processing and inventory management. A standalone warehouse management product with bar coding capabilities is also available. This product will run on workstation or mainframe platforms, providing Cambar an opportunity to meet current needs in warehousing with a downsized solution.

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b. Company Background

Cambar was formed in 1981 to develop products for wholesale distributors and manufacturers. It is a private company with sales of $7.5 million in 1991.

c. Products and Services

Cambar's revenues are generated solely from application software products and related support services. Most of its revenue is from sales of the CONTROL System, which is comprised of customer order processing and inventory management modules that run on IBM mainframes. The warehouse management product that runs on workstations is a more recent development.

5. Dun & Bradstreet Software Services, Inc., 3445 Peachtree Rd., N.E., Atlanta, GA 30326 (404) 239-2000

a. Company Strategy

Dun & Bradstreet Software Services develops, markets, and supports a wide range of industry and cross-industry software products on multiple vendor platforms that provide it the opportunity to market to a number of industry markets. Application software products are available for financial and accounting, human resources, administrative, purchasing, inventory, manufacturing, education, and health industry functions.

A number of computer platforms, including IBM, Unisys, DEC, HP, and Bull mainframe and/or midrange equipment, are supported.

Wholesale distributors use Dun & Bradstreet software products for inventory control, order management and processing, sales forecasting, human resources, accounting, and financial reporting applications. Dun & Bradstreet also provides professional services aid in planning, using, and customizing software products.

b. Company Background

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America, which was acquired in 1990, and McCormack & Dodge, which had been acquired in 1983. The former had been founded in 1963 and had over 24,500 product installations. The latter, founded in 1969, had over 10,000 product installations.

c. Products and Services

This vendor's software addresses a number of functions as described in the following:

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- The Millennium Series supports human resources, accounting, and support functions chiefly on IBM and compatible mainframes, but some products are also available for DEC VAX computers.

- The PLUS series offers accounting and a micro-to-mini link for IBM AS/400's and System/38's.

- Human Resources products are available for IBM and compatible PCs.

- The BrightView Series, which allows the use of intelligent workstations and addresses accounting, inventory, and budgeting functions, uses IBM mainframe and 9370 computers.

- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframes and mini-computers and HP computers.

- Software products are also available for education and factory operations and other functions.

6. Global Turnkey, 4 North St., Waldwick, NJ 07463 (201) 445-5050

a. Company Strategy

This company is an example of a vendor whose service is based on knowledge of the submarkets that it sells information services to. Global Turnkey has maintained expertise in the lumber, electrical distribution, and publishing submarkets in order to sell turnkey systems. Wholesalers and retailers serving the first two markets are among Global's prospects and customers.

b. Company Background

The company was founded in 1968 to develop and market integrated accounting systems to selected industries.

In addition to integrated accounting systems, Global Turnkey is interested in warehousing systems, networking, optical disk, and the use of EDI in its markets.

c. Products and Services

Global has a full set of integrated accounting systems for its chosen markets, including invoicing, accounting, inventory, and administrative systems. Global is prepared to aid clients with EDI services and professional services.

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7. Sterling Software, Inc., EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017 (614) 793-7000

a. Company Strategy

Sterling Software, Inc.'s EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the Sterling EDI Group as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as the use of EDI expands. This strategy is supported with education and results in the highest level of user group activity in the EDI market.

Markets the EDI Group has penetrated include wholesale and retail distribution in grocery, hardware, and housewares, as well as pharmaceutical, medical/surgical distribution, and service merchandising.

b. Company History

The EDI Group was created in October 1990 and includes the ORDERNET Services Division, the EDI Labs Division, and an EDI International Division headquartered in London. The REDINET Services Division of CDC was acquired in 1991 and folded into the ORDERNET Division. Fiscal year 1991 revenues were over $25 million, with 85% of revenues coming from the U.S.

c. Products and Services

About 55% of the EDI Group's revenue comes from software products and 45% from network services. Both software products and network services are offered though the ORDERNET division to over 2,700 customers in the pharmaceutical, grocery, hardware and housewares, retail, medical distribution, mass merchandising, warehousing, transportation, and automotive industries.

ORDERNET provides an on-line network to manage and control the flow of standardized business documents among over 2,000 trading partners.

Services to certain industries are provided through vendors active in those industries. ORDERNET services are made available to hospitals through GTE Health Systems. The medical industry has access to services, including a data base on drug usage, through International Health Applications. Internetwork traffic for the grocery industry is supported through BT Tymnet.

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Electronic transmission of chargeback information between wholesalers and pharmaceutical manufacturers is provided in multiple formats established by national druggists associations.

Translation between established standards for EDI and other standards in use and between a variety of record formats, as well as support of existing protocols on different hardware platforms, are provided with software from the EDI Group.

A data base service is also available to provide EDI documents, such as purchase orders and invoices, that trading partners use during business.

Security services, education, and software maintenance are also offered in support of EDI products and services.

8. Triad Systems Corporation, 3055 Triad Drive, Livermore, CA 94550 (415) 449-0606

a. Company Strategy

Triad is principally concerned with providing information services that will ensure a strong and ongoing relationship and recurring revenues from selected industries, including retail and wholesale segments of the automotive aftermarket, retail hardgoods firms, and dentists.

Services for the automotive aftermarket have been expanded to include turnkey systems that will address the processing and communication needs of a wide range of retail and wholesale establishments, together with software products and maintenance services. Electronic information services that provide automotive parts pricing and catalog updates are also included in support of Triad's strategy to obtain recurring revenue.

b. Company Background

Triad was formed in 1972 to offer turnkey systems to selected markets. The company has also engaged in leasing and third-party maintenance services. Triad had about 11,000 customers worldwide at the end of 1991.

Over 85% of Triad's revenues are from turnkey systems and associated maintenance and support functions; 9% is from EIS; and the remainder is from leasing. The EIS services were the fastest growing component of Triad in the 1990s, growing at a rate of almost 30%.

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c. Products and Services

The Automotive Division of Triad markets turnkey systems with inventory, billing, and accounting functions to distributors, jobbers, retailers, and auto repair shops in the automotive aftermarket. The Information Services Division provides two proprietary data bases for automotive parts pricing and catalog updating to the same automotive aftermarket clients.

The Hardgoods Division provides turnkey systems to hardware stores, home centers, lumber/building materials dealers, and decorating retailers. The Dental Division provides turnkey systems to dental practices.

The Customer Services Division provides predelivery and installation services, customer training, hardware maintenance, software support, and third party maintenance. There is also a leasing subsidiary.

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A

Definitions

No industry-specific definitions have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for the general definitions of industry structure and delivery modes used throughout INPUT reports.

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B

Forecast Data Base and Reconciliation

A

Forecast Data Base

Exhibit B-1 presents the forecast data base for the wholesale distribution sector.

EXHIBIT B-1

Wholesale Distribution Sector
Market Size by Delivery Mode, 1991-1997
($ Millions)

Delivery Modes	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
Sector Total	2,279	11	2,532	2,824	3,169	3,581	4,032	4,573	13
Processing Services	298	3	307	319	341	365	391	418	6
- Transaction Processing	298	3	307	319	341	365	391	418	6
Turnkey Systems	487	7	522	559	604	653	683	731	7
Applications Software	527	11	587	662	743	845	958	1,083	13
- Mainframe	245	4	255	268	275	287	298	317	4
- Minicomputer	122	12	137	152	168	186	200	226	11
- Workstation/PC	160	22	195	242	300	372	460	540	23
Systems Operations	193	19	229	265	308	359	423	502	17
Systems Integration	156	16	181	210	244	285	331	384	16
Professional Services	351	8	380	409	439	472	505	542	7
Network Services	267	22	326	400	490	602	741	913	23
- Electronic Info. Svcs.	63	10	69	78	88	99	112	127	13
- Network Applications	212	21	257	322	402	503	629	786	25

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B

Data Base Reconciliation

Exhibit B-2 presents the detailed 1991-1997 forecast reconciliation for the wholesale distribution sector.

EXHIBIT B-2

Wholesale Distribution Sector
1992 MAP Data Base Reconciliation
($ Millions)

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 Rpt (%)	91-96 CAGR per data 92 Rpt (%)
	1991 Report (Fcst) ($M)	1992 Report (Actual) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)	1991 Report (Fcst) ($M)	1992 Report (Fcst) ($M)	Variance from 1991 Report ($M)	Variance from 1991 Report (%)		
Total Wholesale DistributionSector	2,185	2,279	94	4	3,847	4,032	185	5	12	12
Processing Services	310	298	-12	-4	452	391	-61	-13	8	6
-Transaction Processing	310	298	-12	-4	452	391	-61	-13	8	6
Turnkey Systems	487	487	0	0	683	683	0	0	7	7
Applications Software	527	527	0	0	958	958	0	0	13	13
Systems Operations	79	193	114	144	181	423	242	134	18	17
Systems Integration	156	156	0	0	331	331	0	0	16	16
Professional Services	351	351	0	0	465	565	40	9	6	8
Network Services	275	267	-8	-3	777	741	-36	-5	23	23

Expenditures for 1991 were 4% above the original forecast, driven by increases in systems operations to save costs and increase the level of services to clients.

- Contracts for systems operations rose $114 million above the forecast estimate, and expenditures rose to $193 million in 1991.

- There were only two other variances from original forecasts. Expenditures for processing services were 4% below the forecast for 1991 due to increased interest in moving work to workstation systems. Although expenditures are growing rapidly in network services, they were 3% below original forecasts due to the economic climate in 1991. Expenditures for the other four modes were close to original estimates.

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Due principally to the rapidly rising demand for the use of systems operations services to reduce costs and improve the level of service to wholesale clients, the forecast of expenditures for 1996 of $3.8 billion is being raised to $4.0 billion.

- Forecasts for professional services are being increased by 9% to reflect greater use of consulting, training and application management and/or modification.

- The forecast for processing services expenditures in 1996 was revised downward by 13%, reflecting the shift from that delivery mode to application software products on workstations.

- Although network services is growing at a very fast rate and will be the second largest delivery mode in 1996, the forecast for that year was revised downward by 5% since its growth had been held back or delayed in 1991.

- Forecasts for SI, turnkey systems, and application software products were not changed for 1996.

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U.S. Information Services Industry—Banking and Finance Sector

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I

Introduction

A

Purpose and Methodology

1. Purpose

There are five basic objectives of this Market Analysis Program vertical market report:

1. Industry Introduction - Introduce the reader to the banking and finance industry's structure and demographics.

2. Business Issues and Trends - Identify the business issues and trends that are driving the use of information services within the banking and finance industry.

3. Systems Uses and Issues - Discuss how the banking and finance industry uses information systems, and the issues facing banking and finance industry information systems organizations.

4. Information Services Market - Discuss the information services market within the banking and finance industry, including market sizing and factors driving market demand for each delivery mode.

5. Competitive Environment and Vendors - Discuss the competitive environment and profile leading information services vendors in the banking and finance industry.

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2. Methodology

Much of the data on which this report is based were gathered during 1991 and early 1992 as part of INPUT's ongoing market analysis program. Trends, market sizes, and growth rates are based upon INPUT research and in-depth interviews with users in the banking and finance industry and the IS vendors serving the industry. INPUT maintains ongoing relationships with, and a data base of, all users and vendors that it interviews. Interviewees for the research portion of this report were selected from this data base of contacts.

In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include on-line periodical data bases, subscriptions to a broad range of computer and general business periodicals, continually updated files on over 3,000 information services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that vendors may be unwilling to provide detailed revenue breakouts by delivery mode or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different delivery modes from those used by INPUT. Thus, INPUT must estimate revenues for these categories on a best-effort basis. For this reason, the delivery mode and individual segment forecasts should be viewed as indicators of general patterns and trends rather than specific, detailed estimates for individual years.

When information is provided by vendors as requested, it is often offered under an agreement of confidentiality. Therefore, vendor rankings based on revenue figures should be viewed as approximations.

B
Industry Structure

For purposes of this report, the U.S. banking and finance industry (which does not include the insurance sector, the subject of a separate INPUT report: *Industry Sector Markets, 1992 - 1997—Insurance)* will be segmented as shown in Exhibit I-1.

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EXHIBIT I-1

Banking and Finance Industry Segmentation and SIC Codes

- Commercial banks (602)
  - Money centers and large banks
    - Assets over 5 billion
  - Regional and midsized banks
    - Assets between $1 billion and $5 billion
  - Small commercial banks
- Saving and loan institutions (603)
- Credit unions (606)
- Brokerages and other financial services firms (62X)

The U.S. banking and finance industry, outlined demographically in Exhibit I-2, is highly concentrated. For example, although there are about 12,000 commercial banks in total, approximately 70% of all commercial banking assets are controlled by the 100 largest bank holding companies. With the recent rise of so-called "super-regional banks" (see Chapter II), however, the concentration has been somewhat less at the very top of the industry. For example, in 1975, the 10 largest money center commercial banks controlled 28% of all deposits. By 1989, that level of control dropped to 20%; and now mergers and acquisitions, especially among the largest banks, are again changing the structure of the industry. Some banking industry observers, in fact, expect to see $300 billion to $400 billion giants by the end of the 1990s, reversing the 1975-1989 trend.

Total employment in the industry in 1988 stood at about 3 million, almost half of whom worked for banks. Growth in employment dropped to 0.6% in 1989, down from 1.8% in 1988 and 4.4% in 1987.

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EXHIBIT I-2

U.S. Banking and Finance Industry Demographics

Segment	Number of Institutions	Total Assets ($ Billions)
Commercial banks	12,000	3,500
Saving and loan institutions	2,500	1,300
Credit unions	14,000	175
Brokerages and other financial services firms	N/A	1,500

Note: All numbers rounded

C
Organization and Contents of Report

The remainder of this report is organized as follows:

- Chapter II—Trends, Events, and Issues—provides background information on the business issues and trends that are driving the use of information services within the banking and finance industry.

  The section on trends and events focuses on two areas:

  - The impacts of general business trends, such as globalization of markets, competitive changes, organizational restructuring, and the continuing use of technology to change basic operational practices and to achieve competitive advantage

  - Banking and finance industry-specific trends and events, including profitability issues, restrictions on the banking business, competition, overcapacity, mergers, and other topics

The section on issues identifies specific questions that should be asked and situations that should be addressed in developing a business strategy to provide information services to one or more segments of the banking and finance industry.

- Chapter III—Information Systems Environment—provides an overview of the basic business processes in the banking and finance industry and their supporting information system applications. For example, a discussion of how the banking and finance industry uses information systems to operate and manage its business activities is included. Networks and data communications are included in this analysis.

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The impact of new and emerging technologies on applications and IS organizations is addressed, as are organizational and budgetary considerations.

- Chapter IV—Information Services Market—looks at the banking and finance industry from two viewpoints:

  - By delivery mode: How are these services delivered? INPUT's delivery modes for the banking and finance sector are:

    - Processing services
    - Turnkey systems
    - Applications software products
    - Systems operations
    - Systems integration
    - Professional services
    - Network services

  - By industry segment: Who is buying information services? In other words, what segments within the banking and finance industries are buying services in which delivery modes?

    Overall market forecasts are provided by delivery mode and industry segment.

- Chapter V—Competitive Environment—identifies leading IS vendors in the industry, discusses some of the factors that affect the competitive dynamics of the industry, and profiles representative vendors.

- Chapter VI—Conclusions and Recommendations—reviews the trends and opportunities described in the report and provides recommendations for vendors as well as users.

In addition, there are two appendixes:

- Appendix A presents industry-specific definitions.

- Appendix B presents the forecast data base and reconciliation.

The forecast data base contains a yearly (1992-1997) forecast of user expenditures by delivery mode for the banking and finance industry as a whole, and for each industry segment. The forecast reconciliation compares this report's forecast with the forecast provided in INPUT's previous banking and finance industry report and explains the reasons for any major differences.

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II

Trends, Events, and Issues

This chapter discusses trends, events, and issues in the banking and finance industry.

Section A, Trends and Events, highlights the economic, business and political forces—as well as key technology trends—driving the banking and finance industry, and shows how the industry is responding to these forces.

Section B, Business Issues, identifies specific questions that should be asked and situations that should be addressed by IS vendors in developing a business strategy that is responsive to the industry trends discussed in Section A.

A
Trends and Events

1. General Business Trends

The year 1991 was one in which the recession was expected to end, the recovery to start, and the ambiguities of an uncertain economy to gradually disappear. The end of the Middle East crisis brought a brief euphoria as American troops, victorious in Iraq, returned home to hopes that the end of the conflict would "jump-start" the economy. Some encouraging signs were seen, but by year-end 1991, the U.S. economy was still sluggish, with no clear signs of a near-term sustainable recovery. Phrases such as "all the necessary pieces to initiate and sustain a recovery are in place," have been common in the media, but as of early 1992, the hoped-for upturn in the economy is yet to be seen. Few disagree that a return to economic growth will happen, but opinions vary widely as to when the turnaround will occur, how quickly the economy will rebound and what the new growth rates will be for the country, the various industries and the financial resources that fuel the economy. Most analysts do agree on one thing, however—American workers' faith in the economy, as demon-

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strated by their willingness to spend and invest. Their motivation to compete in the world and domestic markets, demonstrated by the quality of their work products, will have a major role in igniting and fueling the recovery when it does occur.

Recovered or not, however, the U.S. economy is still active and is the major factor in world commerce. As such, a number of national and international business trends continue to impact the banking and finance industry in general, as summarized in Exhibit II-1.

EXHIBIT II-1

Impacts of Business Trends

- 1990-1992 recession in the U.S.
- Global financial services competition
- Third-world debt
- 1980s takeover/LBO-based junk bond debt
- 1989-1992 "rolling recession" in real estate
- Europe 1992

1990-1992 Recession in the U.S. - Official or unofficial, recession in the U.S. finally ended a decade of largely uninterrupted economic growth. As noted below, junk bond debt was one of the first 1990-1991 casualties of the slowdown. The slowdown also raised the rate of business bankruptcies and imperiled banks' portfolios of loans outstanding. Despite this, financial services companies did record a recovery in 1991, as a result of falling interest rates that benefited spread-sensitive institutions such as thrifts and banks, and a stock market that recorded record highs, benefiting brokerage firms, investors and the equity and bond markets. Although much of the data is not yet available for 1991, Exhibit II-2 shows the changes in the banking and finance marketplace from 1970 through 1990. In 1992, the interest rates for the first six entries in the exhibit have maintained their decline to multiyear lows, continuing the trend from 1980 to 1990. Security indexes, on the other hand, have been almost ballistic in their growth, with the Dow exceeding 3,200 in January 1992.

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EXHIBIT II-2

Banking and Finance Marketplace
Key Indicators of Market Performance and Activity

Activity	1970 (Percent)	1980 (Percent)	1990 (Percent)
Fed. Res. Bank of NY Discount Rates	N/A	13.00	6.50
Federal Funds, Eff. Rate	7.18	13.36	8.10
Prime Rate (banks)	7.91	15.27	10.01
Large 3-Month CDs	7.56	13.07	8.15
1-Year T-Bills	6.48	10.89	7.35
New Home Mortgage	8.52	13.95	10.08
Security Indexes:			
- S & P Common	83.20	118.70	334.60
- NYSE Finance	54.60	64.30	133.20
- American Common	48.30	150.60	338.40
- NASDAQ Banks	N/A	118.40	391.00 *
- Dow Jones Composite	243.90	328.20	965.20
Market value: All Sales, All Exchanges	$136 B	$522 B	$2,004 B

Source: *U.S. Statistical Abstract*, 1991 * 1989, 1990 N/A

Global Competition - The increasingly global level of competition facing many U.S. industries is a key business trend for the banking and finance industry as well. Although the largest U.S. money center banks for years have provided a variety of banking services overseas, during the 1980s the reverse became true in two ways. First there was an expansion of the trend that began with the oil shocks of the 1970s when Middle East nations enjoying a trade surplus with the U.S. invested their petrodollars in U.S. property, corporate debt, and government securities. During the 1980s, countries with hard-goods trading surpluses with the U.S.—in particular, Japan—made parallel investments. Such investments helped support debt financing of ballooning U.S. federal government deficits and the overseas trade deficit. Second, Japanese banks for the first time became aggressive acquirers of U.S. banks. One indicator of the increas-

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ingly global nature of banking, and the impact is has on the financial community, is the emergence of strong foreign banks to challenge the major U.S. institutions. Exhibit II-3 examines, over a twenty-year period, the 500 largest banks in the world, and notes the declining percentage of U.S. banks in both number of institutions and assets held. This change is not so much an indicator of weakness in the U.S. banking system as it is the logical outgrowth of stronger European, Far East and Near East economies, various trade imbalances and, in some cases, foreign banks that flourish under strong government support.

EXHIBIT II-3

500 Largest Banks in the World by Location of Bank

	Percentages as of		
	1970	1980	1990
Number of Banks:			
U.S. banks	37.0	18.6	21.6
Foreign banks	63.0	81.4	78.4
Assets in Banks:			
U.S. banks	33.3	15.1	10.0
Foreign banks	66.7	84.9	90.0

Source: *U.S. Statistical Abstract*, 1991

Third-World Debt - High levels of third-world debt continue to impact U.S. banks, especially the large money center banks. For several years in the late 1980s and continuing in some cases through 1990 and into 1991, many banks with heavy exposures to debt held by less-developed countries—especially in South America—went through one or more write-downs of portions of this debt. Some write-downs were self-initiated and some were mandated by U.S. regulators. Banks now realistically anticipate that some or all of this over-extension of credit will never be repaid. Foreign lending by U.S. banks is not limited to just third-world countries, however. Exhibit II-4 summarizes the loans made by large U.S. banks to the four largest borrowers of such funds as of 1989—an amount equal to 40% of all such foreign loans. As the chart notes, although Brazil and Mexico together accounted for 15% of U.S. large bank loans, the U.K. alone borrowed almost that much, and Japan was responsible for more than 10% of the loan balance.

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EXHIBIT II-4

Foreign Lending by Large U.S. Banks
Largest Borrowers, 1989

Country	Amount ($ Billions)	Percent of Total
United Kingdom	31.5	14.6
Japan	21.8	10.1
Brazil	16.3	7.5
Mexico	16.1	7.5
All others	130.3	60.3

Source: *U.S. Statistical Abstract*, 1991

Junk-Bond Debt - The 1980s excesses in the issuance of junk-bond debt to finance corporate takeovers and leveraged buyouts became accountable in the early 1990s, especially as the economic slowdown cut the ability to service the debt undertaken. The result was bankruptcy in some cases and substantial restructuring of the debt in others. Either case impacted banks, savings and loans, and brokerages with substantial junk-bond holdings. In some instances, the debt was swapped for equity in the firms, increasing the debt holders' asset base but cutting their anticipated high rates of (junk-bond) interest return.

"Rolling Recession" in Real Estate - Starting in 1989, well before a generalized recession was widely acknowledged, U.S. banks—especially savings and loans—saw a clear and negative regional pattern: a rolling recession in real estate values, starting in the Southwest oil-patch and the Northeast industrial sectors, and moving into the Southeast, the Mid-Atlantic states, and even the golden California real estate market. Financial institutions (as opposed to the nonbank financial sector), by law, are restricted to a single state or to a largely regional economic base. Thus, each regional roll-down of real estate values meant that substantial portions of the region's banks' asset portfolios were placed in jeopardy at the same time, which simultaneously weakened the collection of interest and the ability to profitably sell failed properties. Despite attempts by the Fed to stimulate home sales through reduced interest rates, the housing market, with a few small exceptions, remains depressed. New home sales and resales are stalled for lack of consumer (buyer) interest, even though prices (offered by desperate sellers) have dropped to 3-5-year lows in some areas. Many homeowners, however, have taken advantage of the low interest rates to refinance homes (purchased in the 1980s) that had high fixed or variable-rate mortgages.

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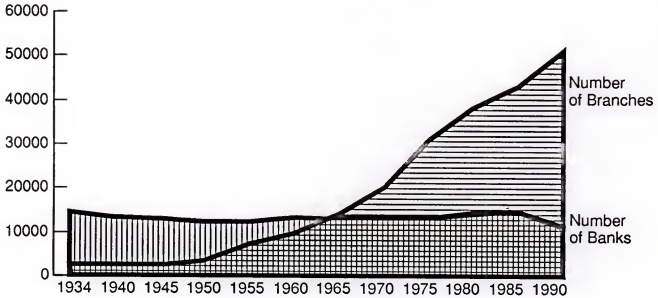
Europe 1992 - Finally, the march toward European trade unification in 1992 continues (albeit with uncertainty about monetary union and the strength of the newly unified German economy) and thereby raises flags of uncertainty about the likely impacts on international trade and finance. Two feared impacts are restrictions on the ability of U.S.-based financial firms to compete in Europe and the possibility of stronger European firms' pushing into the U.S. market.

2. Banking and Finance Industry Trends and Events

The period since the late 1950s has been one of mixed growth for insured commercial banks, as noted in Exhibits II-5 and II-6. In terms of the total number of banks, there has been a very gradual decline since 1934, accelerating from 14,435 banks in 1980 to a 56-year low of 12,338 in 1990. Branches, on the other hand, have grown steadily from the early 1950s to more than 51,000 in 1990. Exhibit II-5 offers a 56-year record of bank and branch growth.

EXHIBIT II-5



* Beginning in 1982, remote service facilities (ATMs) are not included in the count of total branches. At the end of 1981, there were 3,000 such facilities

Source: FDIC - 1991

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Exhibit II-6 summarizes the changes in a number of bank attributes from 1980 to 1990. The one thing that is immediately obvious is that the 1980s was a period of volatility for commercial banks. New bank charters dropped by 20% from 1980, while mergers and consolidations and the number of multibank holding companies tripled. The number of bank failures was 16 times greater in 1990 than it was in 1980, even though the number of banks had declined by 15%.

EXHIBIT II-6

Insured Commercial Banks Changing Environment, 1980-1990

Attribute	1980	1990	Change
New charters	205	165	Down 20%
Consolidated, absorbed, merged	132	390	Tripled
Failures	10	159	16 Times
Number of banks	14,435	12,338	Down 15%
Number of branches	38,736	51,225	Up 32%
Multibank holding companies	284	831	Tripled
Banks owned by holding companies	2,269	3,780	Up 67%

Source: *ABA Banking Journal*, 1991

What is obvious is that the last decade is one in which a great number of changes have occurred in the financial services marketplace. And the last decade of this millennium is one in which such changes will continue to occur.

The mix of key trends and events affecting the U.S. banking and finance industry in the late 1980s and early 1990s can be addressed in terms of the 10 major topics shown in Exhibit II-7.

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EXHIBIT II-7

Key Topics Impacting the Banking and Finance Industry

- The S&L bailout
- Profitability
- Business restrictions and competition
- Overcapacity and mergers
- Cost cutting
- Outlook for regulatory reform
- The shifting credit card business
- Securitization
- Brokerages since the 1987 crash
- Nonbank financial services firms

a. The S&L Bailout

During 1990 and 1991, American taxpayers have watched as the federal government's management of the bailout of insolvent savings and loan institutions (S&Ls) has faltered repeatedly and current and forecast costs have mushroomed. S&L investments in junk bonds and real estate, which are guaranteed against loss to depositors by federal deposit insurance, now imperil an estimated 600 to 800 of the 2,500 S&Ls. Forecasts now range up to $500 billion or more in ultimate costs, including interest.

As a result of the bailout—and especially its ever-expanding costs—a cloud of depositor fear and uncertainty hovers over the entire U.S. banking industry. Without fully understanding the dynamics, citizens watch uneasily as many still-solvent S&Ls sell assets to meet new capitalization requirements and slash costs to bring back profitability. Many banks are buying S&Ls, often with government financial assistance, as the price of keeping the obligations to depositors in private hands.

Early in 1991, the press began to ask if commercial banks would be next. The U.S. Congress—and the banking industry—quickly moved to assure that no bank bailout would be necessary. Nervousness mounted, however, as the increasingly weak New England banking market saw banks with assets of $29 billion—led by Bank of New England—fail during the first

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five months of 1991. In reaction, the banking industry offered its own plan to strengthen the funding of the Federal Deposit Insurance Fund (FDIC) insurance safety net for depositors. Many banks and analysts continue to protest that comparison to the S&L situation is unfair. Commercial banks, they argue, have broader lending bases in business and consumer loans, as well as the more-risky real estate lending. Also, commercial banks today derive an increasing proportion of their income from fees charged on services, such as trust and cash management. Analysts point out that during 1990 "only" $7 billion was recorded in commercial-bank charges against the FDIC insurance fund; this amount, they argue, is minor compared to $500 billion in anticipated S&L bailout costs. The comparison is reassuring, but the uncertainty remains and the recent low rates on deposits is motivating many bank customers to seek alternative investments.

b. Profitability

Banking profitability for the ten largest multinational banks (measured as return on equity) rose to 8.2%% in 1991. Profitability for the top 25 regional banks was significantly higher, at better than 14.8%. In 1990, measured on total assets of $3.5 trillion, the banks earned only $16.6 billion—less than one-half of one percent. A contributing factor was the fact that the 1987-1990 period saw significant cuts in the profits of many money center banks, because of increases in bank reserves for uncollectible debts in less-developed countries. Industrywide profitability dropped in 1989 and 1990 due to defaults on (and expanded loan loss provisions for) high levels of commercial real estate lending in regional markets that are now overbuilt.

To place the 1991 numbers in perspective, in 1990 even the top 100 banks averaged only a 6.5% return on equity (although a few leaders earned over 20%) and in 1989 this rate was 5.6%. Some analysts note that the community banking sector remains relatively insulated, so far, from the problems affecting other financial institutions in the late 1980s and early 1990s, having concentrated on local business lending during that period and avoided the speculative excesses now dogging the S&Ls and midsized regional banks. For all banks in general, however, loan demand reportedly continues to be soft in the 1990-1992 recession, with only isolated signs of a pickup.

A concern is a long-range acceleration in the number of bank failures: more than 1,000 banks have failed in the past 10 years, versus just 500 bank failures in the 46 years from 1934 to 1980! In the last five years the acceleration has been more obvious, reaching a high of 221 failures in 1988. In 1989 that number dropped to 206 and in 1990 to 159, hopefully signaling a trend toward greater stability. Combining S&L and commercial-bank failure statistics brings out a highly regional pattern: in 1988-1990, there were over 600 failures in the Southwest, versus a total of about 350 in all other regions of the U.S.

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To prevent an S&L "replay" in commercial banks, the FDIC insurance fund reportedly needed a short-term infusion of $70 billion or more to stay solvent in 1991—although, even with that addition, only a small percentage of deposit obligations are actually covered. A continuing debate in the industry, and in Washington, centers on FDIC funding and the various mechanisms to achieve adequate FDIC coverage. Banks appear committed, however, to assessing themselves additional FDIC insurance fees to assure fund solvency.

c. Business Restrictions and Competition

Banking Product Options - Until very recently, banks have remained largely restricted by the 1933 Glass-Steagall Act from diversifying beyond basic banking functions, even into related financial businesses such as mutual funds, insurance, and real estate. For this and other reasons, many money center, S&L, and commercial banks resorted during the 1980s to higher-risk third-world and real estate lending to try to boost profits.

The sentiment of the Glass-Steagall Act may now be changing. A recent state action in Delaware (since challenged by the Federal Reserve) opens the opportunity for banks or banking subsidiaries chartered in that state to sell and underwrite insurance within the state and perhaps nationwide. Florida and Illinois, however, have turned back similar efforts. Based on court interpretations, banks already have the power to undertake asset-based underwriting (backed, for example, by credit card receivables). In addition, banks are now starting to win approval for equity-securities underwriting, which the Federal Reserve first granted to J.P. Morgan in 1990; other major banks have now applied. In an interesting competitive twist, stock brokerage firms now want corresponding authority to enter the banking business, or at least access to the Federal Reserve's discount window for emergency borrowing in liquidity crises.

Nonbank Funding Sources - One of the biggest changes to the banking business in the past decade is the availability to corporate borrowers of many nonbank sources of funds. Funding options are available from insurance companies and commercial credit sources, and there is a vastly expanded commercial paper market, aided by Wall Street brokerage and investment banking houses.

In addition to simple lending, a wider range of bank-like services is available from largely unregulated competitors like General Electric, Sears Roebuck, General Motors, and American Express. Recent profits at GE Capital Corp. decreased due to losses on highly leveraged loans, but this sector shows few such problems compared to many banks and S&Ls.

Money-Market Funds - One of the strongest challenges to the traditional deposit business of the banks is coming from ever-stronger money market funds, which increasingly succeed in drawing basic deposits and certificate-of-deposit funds from banks. Money market funds tend to offer return rates 0.5% or more higher than bank rates because money market

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costs are lower due to the lack of branch-bank costs, deposit-insurance fees, and regulatory requirements to hold reserves against deposits. Increasingly, the money-market funds offer check-based withdrawal options and credit cards (actually *debit* cards, since account balances are debited automatically, although overdrafts can be treated as margins against CMA-held securities). Some ATM-based access options are also anticipated.

International Issues - U.S. banks now face foreign banks and finance entities that increasingly compete for U.S. lending business. *The Wall Street Journal* (6/6/91) reported that "foreign and foreign-owned banks made more than 30% of all business loans in the U.S. last year" and controlled 21% of U.S. banking assets and 14% of deposits. Given continued restrictions on U.S. banks as to geographic coverage and nonbanking activities, most of the largest U.S. money center banks rank below top foreign banks in size and scope (see Exhibit II-3). Thus, the international competitive strength of U.S. banks is limited. Today, many U.S. money center banks are decreasing their reliance on institutional and foreign deposits that can quickly move out in a crisis. Rather, such banks are emphasizing more stable consumer deposits, and some have grown (for example, Bank of America) by acquiring deposits of failed thrifts. In parallel, banks are expanding consumer banking services to raise fee income.

d. Overcapacity and Mergers

With the rise of alternative sources for lending and new opportunities for relatively high returns on deposits—and continuing restrictions on alternative business ventures—some analysts draw a picture of a traditional, local-based banking industry being overwhelmed by change. They say that 12,000 banks are too many for the new realities of the U.S. financial business.

As evidence, many cite the rapid consolidation in the midsized sector of the business since a 1985 Supreme Court ruling permitted a state to make local reciprocal banking agreements with other nearby states. Consolidation has given rise to a new class of super-regional banks that were built up through mergers and acquisitions. To date, money center banks have been excluded from such agreements because states view such banks as too powerful. Some expect this resistance to erode soon, however, as states permit acquisitions from out of the region. Wider geographic arrangements may still prove limited, however, because the cost economies are far greater on an intraregional deal, where operations can be centralized without being far from either player.

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In his 1992 "State of the Union" speech, President Bush proposed a broad range of remedies to stimulate the economy, one of which was a rekindled interest in national banking. Should it become easier for banks to cross state boundaries and grow where markets dictate, the rate of mergers, acquisitions and consolidations will almost surely accelerate.

In 1991, merger activity continued, with the most prominent courtship being that of Bank of America for Security Pacific. BofA is expected to consummate its $4.4 billion acquisition of Security Pacific in early 1992, and the resulting bank, with over $190 billion in assets, will be one of the largest in the world, and second in size in the U.S. to Citicorp ($215 billion in assets). Most mergers have resulted in closing of duplicate branches and heavy staff cuts, and thus strong local opposition has been common. Such opposition, however, has not seemed to slow the pace of mergers and acquisitions at all, and many predict that by the turn of the millennium, $300 billion and $400 billion banking giants will dominate the economy.

Despite local opposition, it seems especially likely that in the future there will be more acquisitions of midsized banks (with assets in the $1 billion to $10 billion range) by recently established or new super-regionals. Such mergers clearly can be rational from a cost-cutting standpoint. Once merged, the larger institution's competitive position can be improved by the opportunity to offer a broader range of banking services and to spread the cost of more-sophisticated computer systems over a broader base. On the negative side, in terms of local and human impacts, some see as many as three-quarters of a million bank employees laid off through such mergers in the next decade.

This raises a key policy consideration: that of managing the transition of the banking industry out of overcapacity more effectively than the S&L excesses (and, perhaps, overcapacity) have been managed to date. Some note that the current administration's plan for reforming banking regulations would permit rational, businesslike exits from banking in a time of overcapacity and permit banks to reapply capital to other businesses, much as the steel industry has done in recent years. In this way, not all banks would be forced by restrictions into holding on and fighting for shares of a declining market. If such a competitive climate were to occur, many banks could fail at taxpayer expense.

e. Cost Cutting

Against the financial and competitive backdrop just outlined, it is scarcely surprising that cost pressures in general and cost cutting in particular are primary issues for almost all banks today. Under the profit center concept, controlling and reducing costs of operations across all bank activities has become the norm, and one route is the merger wave described above. In the Bank of America-Security Pacific merger, BofA's stated goal is to cut

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operating costs by $1 billion within 3 years, with $300 million to $500 million reportedly coming from a consolidation of data processing resources. More generally, the costs of information systems and services are being scrutinized ever more carefully by cost-cutting bank management.

f. Outlook for Regulatory Reform

As alluded to earlier, banking regulatory reform looks inevitable in some form, although the final shape is anything but clear. The following paragraphs examine some of the more important regulatory activity.

Capital Ratios - The major banking industry regulatory change to date (beyond the S&L bailout structure) is that banks' capital-reserve requirements have been raised significantly, which cuts the total volume of loanable funds. Banks at all levels are under increased-capital-ratio regulatory mandates.

In the case of industry giant Citicorp, for example, the target is to raise capital levels by as much as $5 billion. In addition to slashing expenses so that increased profits can be fed into the bank's capital base, Citicorp reportedly wants to raise $1.5 billion through the securities market, with perhaps another $1 billion coming from a new issue of common stock.

Through issues of equities and bonds, banks raised almost $5 billion in new capital during just the first quarter of 1991. For banks at all levels, the outlook is that regulators will require further increases in capital ratios.

Federal Proposals - As the nation enters an election year, the Bush administration has proposed a wide range of commercial banking reforms. Proposals in 1991 included substantial bank participation in securities underwriting, insurance, and even nonfinancial businesses (permitting institutions to make an orderly exit from banking in a time of overcapacity); interstate banking; limited reform of deposit insurance to shift risk from the FDIC government fund (and thus the taxpayers) to bank shareholders; and elimination of or limits on insurance for brokered deposits. Also proposed were radical separation of deposit and lending functions, especially to shield insured deposit funds from risky lending, and the basing of deposit insurance premiums on the riskiness of the loan portfolio, perhaps through privatization of the deposit insurance system. Considering the implication of wide-ranging reforms, some believe the banks' broad base of branches would be the ideal distribution system for other financial products.

Congressional Action - Although wide-ranging banking industry regulation reforms were proposed in 1991, little congressional action on the proposals was seen. Indeed, many doubt that significant reform legislation will pass in 1992. Robert Glauber, widely regarded as the author of the White House's 1991 "Modernizing the Financial System" prescription for

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the banking industry, believes that 1991 was a year of banking education for Congress, and that although there were pressures from various lobbies, none was strong enough to get anything done. In any case, the most likely reform to find its way into law in 1992 will be interstate banking—an action that could occur independently of any other legislation.

FDIC Status - Hovering over all the proposals is a major short-term worry: the balance in the FDIC insurance fund has dropped from over $18 billion at the end of 1987 (to cover $1.6 trillion in deposits at that time) to just $10 billion at the end of 1990 (to cover $2 trillion in deposits now). As noted earlier, the commercial banks appear to be agreeing to further fund the FDIC. Increased funding will also be beneficial to the banks in distancing themselves from the S&L bailout's impact on taxpayers. On this issue and on the larger issue of regulatory control of the S&Ls and the commercial banks, however, there is ongoing political debate on the future roles of the Federal Reserve, the Treasury, the Comptroller of the Currency, and other current or future regulatory bodies.

Credit Unions - There is also a possible side effect of proposed banking industry reform that some argue is a conscious plan by banks, but others see as an unintended impact: proposed regulations that would increase costs for the nonprofit, generally local credit unions by making changes in how they account for deposit-insurance premiums versus assets. The regulations would eliminate a cost advantage that such institutions now have over banks and S&Ls. Credit union members, of course, are lobbying hard against this provision.

g. The Shifting Credit Card Business

Scope of the Credit Card Market - Few outside the industry realize how important a financial force credit cards have become. They now account for 30% of all consumer borrowing, with over $360 billion in billings in 1990. Yet, as indicated in Exhibit II-8, half of the top-used credit cards are issued by nonbanks.

Nonbank Presence - Overall, the credit card business is less and less controlled by banks: the nonbank share of card receivables had risen to 16% in 1990. Yet, for the big-bank players, credit cards are a major and important business. In 1990 the card business represented 69% of Citibank's profit. Among banks, credit cards are increasingly a big-bank service. The trend has been for small and midsized banks to sell their credit card businesses and apply capital and reserves elsewhere.

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EXHIBIT II-8

1990 Billings of Top Credit Card Issuers

	($ Billions)
American Express	88.3
Citibank	40.3
Sears Discover	19.4
Sears Roebuck	16.8
First Chicago	13.0
Chase Manhattan	11.4
MBNA*	11.0
Bank of America	10.4
J.C. Penney	8.7
AT&T Universal	4.4

* Formerly MNC Financial

Source: *Business Week* 1991

Exhibit II-9 notes the percentage of general-purpose credit cards issued by major institutions over the period 1988 to 1990. The percentage of the market held by the three largest issuers (Greenwood Trust/Discover, Citicorp and American Express) has steadily increased, from 28.6% in 1988 to 32% in 1990, a growth of almost 12%. During that same period, the number of general-purpose cards in circulation grew by almost 15%.

EXHIBIT II-9

General-Purpose Credit Cards

	1988	1989	1990
Total U.S.-held general-purpose cards (Millions)	256.7	272.5	294.5
Percent of market held by sixteen largest issuers	46.7	52.0	56.7
Percent of market held by three largest issuers	286.6	30.8	32.0

Source: *ABA Banking Journal*, 1991

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Among the nonbanks, the successful upstarts include Sears' Discover Card and, more recently, AT&T's Universal Card. The latter has already captured 8.5 million active cardholders and is still growing fast, with over $4 billion in 1990 billings. In addition, there are many other nonbank-issued cards, including special-interest cards that often pay dividends to chosen causes.

h. Securitization

An important trend impacting banks and nonbanks in the financial services industry is the increasing trend toward securitization—the packaging for reselling and/or trading of blocks of loans of all types. The lending agency that packages loans in this way earns a fee for the packaging and moves loans off the financial books, thus freeing the capital for lending—and securitizing—once again.

In fact, a major reason for the S&Ls' loss of mortgage business has been the increasingly widespread securitization of mortgages through GNMAE, FNMAE, and others, thus permitting low-capital mortgage brokers and others to compete easily, often under lower cost structures.

i. Brokerages

As CD rates dropped below 5%, small and large investors turned to stocks and bonds, pushing the Dow over the 3,000 mark. There were also many new issues, and the final count of capital raised in 1991 could be as high as $15 billion. Exhibit II-2 noted the changes in various security indexes from 1970 to 1990. In 1991, for the first 11 months, further gains were reported for all indexes, and the S&P brokerage stock index doubled. In general, retail brokers did very well. Not surprisingly, though, the long-term, multiyear trend of decreased trading volume (despite the recent upswing) means continued tight budgets for brokerages' spending on information systems and services. Brokerages are emphasizing efficient use of installed systems, not big investments in new systems.

j. Nonbank Financial Services Firms

As mentioned in several of the subsections above, a strong new class of banking industry competitors is emerging: nonbank financial services firms. Whether in credit cards, lending, or nondepository interest-bearing accounts such as money market funds, more and more nonbank institutions serve the financial needs of individuals and businesses today. These institutions generally are well capitalized—often by industrial-sector parent firms—and generally operate free of most of the regulatory constraints imposed on banks and S&Ls. There is every reason to believe that nonbanks will continue to win business from traditional banking firms in the future—and thus will invest relatively more heavily than the rest of the sector in information systems and information services.

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3. Technology Trends Impacting the Banking and Finance Industry

Exhibit II-10 summarizes the information technology issues facing the banking and finance industry in the 1990s.

EXHIBIT II-10

Information Technology Issues for the Banking and Finance Industry

- Established technologies
- Imaging
- Expert systems
- Downsizing and outsourcing
- Disaster recovery
- Distributed systems and integrated data bases
- Communications
- EDI
- Workstations
- Home/remote banking
- Debit cards and smart cards

a. Established Technologies

A number of information technologies are already well established in the banking and finance industry. The most significant of these are noted below and share a common attribute: each automates a traditionally labor-intensive function, improving both service to the customer and financial institution labor costs.

Platform Automation - The value of platform automation is now almost universally accepted in the banking industry; the technology is in widespread use now, after a relatively slow start. This technology cuts costs by allowing each bank teller to capture every transaction directly and immediately as an on-line function, not at the end of the day as a batch operation.

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Voice Response - Similarly, it is becoming very common for banks, brokerage firms, and other financial institutions to use voice response systems to allow customers to obtain balances, records of checks cashed and deposits, and other information from touch-tone phones.

ATMs - ATMs are now accepted alternatives to routine transactions with human tellers. Many observers note, however, that any early competitive advantages that banks gained by being ATM pioneers have now evaporated, and ATMs are now essentially a competitive necessity, albeit one that may serve to keep teller and transaction costs somewhat under control. It is ironic, though, that banks now have more ATMs in operation than ever before, yet are keeping branches open with paid staff for longer hours than in the past.

b. Imaging

Imaging is the hot new technology of the 1990s. The following paragraphs discuss the issues relevant to the banking and finance industry's use of imaging technologies.

Motivation - Almost all banks and financial services firms appear to be examining and evaluating imaging at some corporate level. The top attraction appears to be the decreased costs of check handling. Imaged but checkless statements, besides being less costly, may be attractive in luring new banking customers and an advantage in retaining existing ones in the newly competitive deposit and checking arena. To speed paperwork processing, there are also good imaging opportunities in the handling of loan application documents, and virtually all other key business documents.

Costs and Benefits - The stumbling block, especially at this time, is cost. Mainframe-based systems (the size required for mid- to high-volume bank applications) start at $2 million for a stripped system, with a new high-performance system from IBM ranging in price from $10 million to $20 million. (In an interesting alliance between a hardware manufacturer and a consulfing service house, Unisys and Cincinnati Bell Information Systems jointly offer an imaging system for check processing.) One estimate is that a bank needs 3 million transactions a month to cost-justify a large image-processing system. The Bank of Boston, for one, believes such costs are justified, albeit for a workstation-based system. The bank reports that an imaging system to automate the management of deposit accounts has resulted in a 40% increase in productivity after a staff cut (through attrition) from 41 to 25.

Standards - To date, few banks are using imaging systems. Among nonbanks, American Express has led the way for several years by using an imaging system based on networked PCs and workstations, not a mainframe. Besides costs, continuing obstacles to imaging's growth include lack of standards and lack of full integration with other banking systems.

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c. Expert Systems

Expert systems in banking and finance have proved to be a disappointment. Compared to rosy expectations in the mid-1980s, when the use of artificial intelligence was considered a major future benefit of the application of computer technology to banking needs, there is yet relatively little use of expert systems for lending applications, with somewhat better acceptance for credit scoring. The most extensive use of banking and financial expert systems to date has been by stock brokerages, especially to drive high-speed programmed trading from powerful workstations. But programmed trading, after recent market turbulence, has come under strong scrutiny.

One of the main pioneering uses of expert systems to date has been by American Express, whose workstation-based Authorizer Assistant helps speed approval of credit card purchases. In the future, expert systems technology likely will aid in the monetary union of Europe (assuming the political obstacles involved are overcome), and will minimize the complexities—and business opportunities—of integrating multiple national currencies.

d. Downsizing and Outsourcing

The dominant organizational concepts for the early 1990s are downsizing and outsourcing. Major trends in these areas include:

Consolidations - Late in 1990, Manufacturers Hanover Trust set the pace for cost control through computer-operations downsizing by announcing it would consolidate eight data centers into just two, with major cuts in staff. In the 1991-1992 timeframe, significant mergers include Manufacturers Hanover and Chemical Bank, BankAmerica and Security Pacific, and NCNB and C&S/Sovran. In each of these mergers lies the potential for major consolidations to reduce costs. Other less dramatic examples will certainly occur throughout the next few years.

Processing Services - Given today's cost pressures, banks and processing services vendors report that a far higher proportion of large and midsized banks are considering—and more often implementing—outsourcing of processing to third-party service vendors than in the recent past. Smaller banks, in contrast, increasingly are using recent advances and cost decreases in minicomputer technology to install turnkey systems that eliminate the unit-transaction-based fees charged by processing service vendors.

Systems Operations - In late 1991, Perot Systems agreed to take over the IS function for NCNB, the largest super-regional bank in the U.S. This outsourcing contract is estimated to be worth more than $200 million to Perot over 10 years. Perot will acquire NCNB's Richardson, Texas data

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center, as well as a center in Charlotte, North Carolina, and plans to hire approximately 200 NCNB employees. This is an ever-increasing trend in banking—the placing of operational responsibility for computing resources (up to and including the full IS function) in the hands of computing specialists who will satisfy the bank's processing needs on a contract basis. Where the processing function is not relegated to a specialist, frequently a bank will contract with a systems integrator to merge, consolidate, upgrade or otherwise improve the bank's processing environment and resources. Systems integration and systems operations vendors are benefiting from the growing trend to use data processing specialists to manage or advise on the management of the banking DP function.

Changing Demands - The wave of banking mergers and acquisitions is resulting in a new set of requirements and information services opportunities to integrate disparate information systems. Many professional services and systems operations firms now offer such services as part of their packages.

e. Disaster Recovery

Regulations issued by the Federal Reserve Bank and the Comptroller of the Currency now require that banks have comprehensive plans to recover business within eight hours of defined disasters. Thus, vendors anticipate a big increase in business for disaster recovery firms, with some increase estimates ranging as high as 500%. Not surprisingly, the extended August 1990 power outage in Manhattan scared many financial institutions. Citibank alone reported losing $100 million.

f. Distributed Systems and Integrated Data Bases

As in other industries, many midsized banking and finance firms are placing decreasing emphasis on minicomputer-based distribution of information systems functionality and increasing emphasis on local PCs (with or without disks, for security purposes) tied cooperatively into mainframe data bases. Banc One, for example, is implementing 15,000 to 20,000 PCs in cooperative processing with its mainframes.

To support relationship banking, firms are finding RDBMS technology essential for implementing comprehensive, relationship-based customer account records. Banks believe that integrated customer information systems provide competitive advantage by attracting customers (business and personal) with single-statement summaries of financial status and by permitting the bank to cross-sell additional services whenever there is an interaction with the customer. Clearly, such systems require integration of separate account-based data bases. Similarly, RDBMSs are the key to implementing the transition from operational automation to strategic, competitively-oriented information systems, including executive information systems. One interesting note from INPUT's interviews with banks is

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that many senior banking executives have yet to endorse the benefits of a carefully-crafted executive information system, and IS executives feel that they still have an uphill battle to implement such applications. Many IS managers feel that a major step forward will be taken when senior bank officers have a terminal or PC on their credenza and use it as a part of their daily activities.

g. Communications

Most banks are increasing their use of local-area networks (LANs), and some banks are now at the stage of integrating multiple LANs and centralizing control and backup operations. Some banks are also integrating LANs with wide-area networks and/or integrated corporate communications networks. There seems to be little movement toward ISDN (integrated systems digital network) communications technology.

h. EFT/EDI

In terms of direct electronic transmission of financial transactions, electronic funds transfer (EFT) is well established among banks, with some advancing further in the automation of money transfer functions, such as the automatic routing of EFT messages.

Some banks expected EDI (electronic data interchange) to follow EFT in the next wave of popular applications. However, in other industries, EDI permits business-to-business financial exchanges by end-user organizations without need for a banking intermediary, thus potentially eroding bank revenues. In addition, EDI acceptance by banks is also limited somewhat by lack of full compatibility among three separate standards, all in use by the banking and finance industry: ANSI X.12, UN/EDIFACT, and the separate standards of the National Automated Clearing House Association. It remains unclear whether banks will move aggressively and try to dominate the financial EDI market, or leave it to other EDI players, both established and new. To date, however, relatively few banks are offering to sell EDI services and/or software to others.

i. Workstations

For several years, high-speed, high-powered workstations have been serving the fast-response, complex needs of specialized brokerage traders, such as those in international currency trading. More recently, workstations have been used in banking for complex functions such as cash management.

Workstation technology will become even more important as international communications-based financial markets—and 24-hour trading opportunities—become reality and step up trading complexity by an order of magnitude.

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j. Home/Remote Banking

To date, there has been little market enthusiasm for home-PC-based banking, and many banks have shut down pioneering and experimental systems. The new trend appears to be telephone-based systems, with or without new display telephones.

k. Debit Cards and Smart Cards

Debit cards—debiting the user's bank balance immediately through a communications link—are being explored by banks wanting to cut the float and are resisted by many users for same reason. Predictions vary on whether debit cards will ever replace traditional credit cards. Some see a stronger evolutionary trend in fast-food restaurant experiments, whereby quick and automatic telecommunications inquiries against bad card lists cut waiting time to acceptable levels for small credit card transactions.

As pioneered in Europe, smart cards in the future likely will carry electronic balances on implanted chips, for instant debiting as an alternative to cash.

B
Business Issues

The following is a brief summation of the key business issues and systems opportunities for the banking and finance marketplace discussed in greater detail earlier in this chapter.

Banking and Finance—Key Business Issues

- The lasting effects of the S&L bailout
- International and domestic bad debt
- The continuing impact of the recession
- Lower bank profitability
- Regulatory reform
- Cost controls
- Competition, overcapacity and mergers

Banking and Finance—Key Systems Opportunities

- Downsizing and outsourcing
- Imaging
- Distributed and integrated systems
- Workstations
- New charge card technologies
- Disaster recovery

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III

Information Systems Environment

Based largely on primary-research interviews with selected banking and finance firms, plus secondary research using other industry sources, this chapter examines the global issues driving the IS function, outlines how the banking and finance industry uses information systems, and details the key business and technical issues facing information systems management, as well as the impacts of key new technologies. In addition, a review of organizational control of, and budgeting for, information systems provides the foundation for a discussion of key objectives and plans for information systems departments within banking and finance institutions.

A
Global IS Issues

As the industry approaches the middle of the 1990s, four key issues, as noted in Exhibit III-1, are influencing the course of information systems in the bank and finance marketplace and virtually all other industry segments. First are the structured, planned changes that are occurring—a process which can be called re-engineering—in both the industry and the data processing function. This change, being driven by the economy, regulation, technology, competition and other pressures, is forcing most business segments to consider how they have done, are doing and might better do their core business activities Among other considerations, this analysis forces an evaluation of where the IS function is performed, including what portions of it (up to and including the total IS function) can be most cost effectively performed outside the institution via outsourcing. Mergers, consolidations and general budget constraints drive downsizing considerations, to both reduce the inherent redundancies of merged organizations and to trim the organizational excess resources that accumulate during periods of growth and relative technological stability. Finally, open systems and networking are making it easier to become part of the national and global marketplace and take competitive advantage of the many new applications and service offerings that such standards and networking resources encourage.

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EXHIBIT III-1

Banking and Finance Marketplace
Global IS Issues for the 1990s

- Re-engineering
- Outsourcing
- Downsizing
- Open systems/networking

B
IS Environment

Applications Environment - One way to understand the environment in which the IS issues facing the banking and finance industry are taking place is to examine the applications delivered by IS to both the institution for its own internal use, and to the marketplace to support products and services. Although some applications used by banking and finance firms are common to other industries, many listed in Exhibit III-2 are unique to banking and finance.

Another viewpoint of the banking industry can be gained by examining the transaction volumes appropriate to the marketplace. In its 1988 annual report, Bank of America noted the *daily* volumes of items processed by its IS function. Offered as Exhibit III-3, this glimpse into the processing world of banking highlights the huge daily transaction volumes common to the industry. Of interest is the 60.6% of the load represented by demand deposit (check) processing. Although volumes will almost certainly be higher in 1992, the proportions are still probably valid. The magnitude of the check processing activity explains the interest in, if not yet the implementation of, image processing.

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EXHIBIT III-2

Key Banking and Finance Industry Information Systems Applications

- Customer information file
- Check processing
- Account reconciliation
- General ledger
- Cost accounting
- Proof of deposit
- Integrated deposit system
- Loan origination
- Loan processing
- Loan syndication
- Loan accounting, tracking, and loss control
- Loan servicing valuation
- Profitability analysis
- Collection and recovery
- Time account processing
- Mortgage origination
- Mortgage processing
- Payroll accounting
- Accounts payable
- Asset/liability management
- Fixed-asset management
- Branch automation
- Telephone inquiry management
- Financial planning
- Investment portfolio management
- Securities accounting
- Equipment leasing
- Vehicle leasing
- Safe-deposit management and accounting
- Shareholder accounting
- Budgeting
- Long-range planning
- Regulatory compliance
- Executive information systems

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EXHIBIT III-3

Daily Transaction Volumes
Bank of America, 1988

Item	Count	Percent of Transactions
Checks	12,100,000	60.6
Travelers Check redemption	3,600,000	18.1
Pieces of mail	1,112,000	5.6
Credit/Debit card transactions	995,000	5.0
Consumer deposits	650,000	3.3
ATM transactions	598,000	3.0
Statements	539,000	2.7
Business deposits	220,000	1.1
Customer inquiries	77,000	0.4
Wholesale funds transfers	49,700	0.2
Total transactions	19,940,700	100.0

Source: *Bank of America Annual Report*, 1988

Reaction to the Recession - In response to recession-induced pressures, most banks and financial institutions have, over the last few years, taken steps to either contain or reduce costs. Exhibit III-4 notes actions most commonly applied to the IS function. The consolidation refers to internal efficiencies, as opposed to those resulting from mergers or acquisitions. Decreases in contract programming, layoffs (and attrition), system standardization and reductions (where possible) in maintenance expense are cost-control efficiencies that banking—and virtually all other industry segments—found to be prudent as the economic impacts of the recession affected a larger and larger portion of the economy.

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EXHIBIT III-4

Reactions to the Recession
Cost Controls Applied by Banks
to the IS Function

- Employed fewer independent programmers
- Reduced internal DP staff
- Standardized on fewer application systems
- Reduced maintenance expenditures
- Consolidated networks
- Consolidated data centers

Source: *Computerworld*, 1991

Cost/Benefit Pressures - Even though bank profitability has improved, few banks have reduced the pressures to control bank costs, including those of information systems. Some critics, in fact, argue that many banking systems investments—ATMs in particular—have lowered bank profits, not raised them, by introducing new costs without corresponding financial benefits. They wonder whether many bank information systems have become costly, competitively required investments that have not provided significant competitive advantages. The emphasis for banking systems investments, now and in the near future, clearly is on demonstrating quantifiable benefits before the money is allocated, and then achieving benefits in practice.

Outsourcing - As a result of cost consciousness and a desire to return to their core business—banking—many more institutions now favor shifting to a processing service or to outside systems operation of data facilities. In addition to direct operating-cost benefits, such arrangements generally free bank capital, which these days must be husbanded carefully in the face of regulators' requirements for higher capital ratios. Exhibit III-5 notes the recent outsourcing arrangements established by five of the top 50 banks. IBM, EDS and Perot Systems are some of the major vendors of such services, and the significance of the outsourcing movement can be demonstrated by the fact that 10% of the largest banks are using it to control costs.

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EXHIBIT III-5

Bank Outsourcing

	1990 Fortune 500 Rank	Outsourcing Vendor
NCNB	7	Perot Systems
First Fidelity Bancorp	24	EDS
Continental Bank	26	IBM
Southeast Banking Corp.	44	IBM
First City Bancorp	45	EDS

Source: *Computerworld*, 1991

Downsizing - Some banks are taking advantage of technological advances to downsize from multiple data centers. Relatively few banks so far, however, are undertaking the up-front investment to downsize by moving mainframe-based systems to networked PCs and workstations. In addition to the initial investment, an obstacle to the PC environment is that the kinds of operations now on the mainframe, for most midsized and larger banks, cannot yet be handled effectively on the smaller platforms, even given recent advances in processing power. In part, this is a peripheral limitation. To date, most of the key high-volume peripherals that are integral to banking functions (such as check-processing systems) are available only for mainframe attachment. A new class of such systems—designed specifically for use with networked PCs and workstations—will be required before downsized systems can supplant mainframes in banks.

Technology - Several key technology issues face banking and finance systems managers, with significant business implications. In the cost-controlled environment faced by most banks today, new technological investment is seldom a primary planning topic. The most important issue, typically, is finding new ways to use existing systems more efficiently, including opportunities to downsize operations. However, once the downsizing or outsourcing decision is made, the potentially disruptive impacts must be managed carefully. For instance, some vendors offer a transition service whereby the bank's existing software systems are operated for a time on the processing service's computers, with transition to the service's standard packages taking place in an orderly sequence over time, not all at once.

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The apparent short-term exception to limits on systems investment is funding of the transition from older bank data base systems to relational data base systems (RDBMSs). There are several key motivators for this shift. First, in situations where a bank has taken over or merged with one or more other banks, there is the need (near- or long-term) to integrate each bank's separate processing systems. Implementation of an RDBMS can aid this integration. Second, banks historically have kept records on each account for each client separately, with little or no integration. However, integration is required for relationship banking to be successful, and is made feasible by RDBMSs. RDBMS-integrated account records, for example, allow a teller processing a routine checking deposit to note that a customer's 90-day certificate of deposit is due to mature in two days and thus direct the customer to a desk officer who can discuss reinvestment options. Finally, requests for executive information systems, to better manage the business in the competitive environment of the 1990s, generally require RDBMS technology.

Disaster Recovery - As mentioned earlier, disaster recovery is no longer an option—new regulations require it. Most banks are approaching disaster recovery from the standpoint of contracting with outside disaster recovery firms, and in some cases are installing backup power supplies as well.

C
Impact of New Technologies

Some new technologies are affecting the way banking and finance firms design and implement their information systems.

RDBMS - RDBMSs, especially IBM's DB/2, are already installed or are being installed at many large and midsized banks. Given the competition for deposits versus money market funds and other nonbank investments, many banks want to emphasize relationship banking, which takes into account *all* of the customer's business with the bank. Relationship banking makes installation of an RDBMS a competitive necessity.

Imaging - Imaging, in early 1992, appears to be the technology that everyone is familiar with, everyone is studying, but no one has yet fully implemented. Stated another way, although relatively few institutions have implemented such systems (American Express, a nonbank financial institution that pioneered imaging for charge slip records, is a noteworthy exception), several variations are being examined by most sizable banks. Variations include imaging of checks and moving the images to statements (rather than further handling of the paper checks), direct output of lengthy documents (such as daily balances accessed by few bank staffers) to image systems rather than paper, and capturing the many nonstandard documents required for mortgages and other loans in image systems. Two goals for imaging systems are flexible access and the satisfaction of record retention requirements.

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The stumbling block for imaging is fixed costs—complete systems range as high as tens of millions of dollars. Today's cost-cutting environment tends not to support such investments without clear proof of short-term payback—which, at this time, is not readily apparent for imaging. In spite of this, however, some industry watchers see a significant growth in the sale of image management systems, as shown in Exhibit III-6. A 28% growth was estimated for 1991, and the forecast for 1993 is a growth of 1,790 units. INPUT feels that these estimates anticipate an improved economy and the reduction of bank IS cost constraints. If these do not occur, the forecast will probably shift ahead a year, with 1992 and 1993 units at 450 and 600, and the strong improvement occurring in 1994.

EXHIBIT III-6

Image Management Systems
Financial Services Marketplace
1990-1993

Year	Financial Services Purchase Forecast (Units)	Change from Prior Year (Percent)
1990	352	-
1991	450	+28%
1993	1,790	+298%
1990-1993 CAGR = 172%		

Source: *Computerworld*, 1991

Expert Systems - In the mid-1980s, many saw expert systems as a bright new systems star for banking, especially for credit scoring, loan authorization, and credit card charge approvals. Although examples of all such applications exist, there appears to be relatively little enthusiasm among banks for moving further with expert systems. A notable exception is the deepening commitment to the Authorizer's Assistant expert system by the nonbank American Express. The bottom line seems to be a lack of documentation of hard-dollar payoffs, and the as yet undemonstrated ability of most systems to deal effectively with enough of an application area to cost-justify their use.

EDI - Electronic data interchange, the direct computer-to-computer transfer of information such as orders and deliveries, as well as financial transfers such as funds and payments, continues steady growth outside of the banking sector. Although all banks routinely use electronic ACH

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(Automated Clearing House) facilities and most participate in wire transfers of funds, few banks appear to see themselves in future roles as EDI intermediaries. In part, this pessimism springs from the already-entrenched position of service bureau vendors outside banking, and in part the pessimism may be due to a view that disintermediation—the elimination of middlemen such as banks in financial transactions—is the ultimate goal of EDI and thus is ultimately counter to the banking industry's interests.

The development of a nationwide electronic payment infrastructure in the U.S. banking industry is impeded by the fragmentation of the industry because of regulation. Payment services are profitable when a few large providers serve the entire market. Because the banking industry is fragmented, and the bank's electronic payment systems are not uniform throughout the industry, the infrastructure for payments may take some time to develop. In addition, the market is small, and although it is growing (in terms of volume) at 50% per year, it is still not a lucrative business for banks. As a result, most banks are offering payment services primarily to satisfy important customers, not to make money. At this time, 300 banks have the ability to do EDI processing, and about 50 are actively providing such services. Major providers include First Chicago, Mellon, First National of Detroit, Chase and Wells Fargo.

Workstations - For several years now, high-powered workstations have become the vehicle of choice to execute high-speed, high-profit transactions in such fast-changing brokerage environments as currency trading—or, some would say, workstations are the villain in crash-inducing program trading. As costs drop and workstation power increases, their use for such applications no doubt will accelerate. To date, however, the banking and finance industry has found little other use for workstation technology, and future applications remain unclear—except, of course, to the extent that banks begin to enter the brokerage business.

Tools - Finally, CASE and 4GLs may have noteworthy roles to play in many institutions' evolution from multiple merged-bank systems to integrated systems. CASE in particular will have to deliver more effectively on its longstanding promise to help information systems managers re-engineer old systems before its application will become widespread.

The Future - As budget restrictions disappear and technology continues its functional and performance improvements, the new millennium should see levels of performance that exceed current capabilities by a significant amount. Exhibit III-7 notes Thomas Steiner and Diogo Teixeira's estimate of what the year 2000 will offer in performance improvements for various technologies. Even if only half the improvements are achieved, price/performance ratios will take another giant step up.

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EXHIBIT III-7

Changes in Technology Performance Characteristics for the Year 2000
(1990 = 1)

Technology	Year 2000 Performance Improvement
Artificial intelligence	20x
Image processing	10x
Cost per character for rotating storage media	9x
Mainframe MIPs	4x
Relational DBs for transaction processing	3.5x
Mass storage access time	
Software development technologies	1.5x

Source: *Technology in Banking,* Steiner and Teixeira, Dow Jones-Irwin, 1990

D
Organization and Budget

Although banking and finance industry budgets, in general, are highly centralized, many banking firms maintain a split between back-office systems and the computers and equipment that implement field networks of ATMs. Fully decentralized exceptions to this pattern, of course, do exist. Chargeback systems are common but not typical of the majority of firms.

Overall, corporate budgets in general and bank systems budgets in particular are tight. As noted earlier, this pattern holds for brokerages as well, but many nonbank financial services firms are enjoying higher profit levels and are investing more heavily than the sector average in information systems. Industry estimates for 1991 IS growth ranged from 5%-6% for all industry categories, to 3%-6% for banks and financial services. INPUT estimates the 1991 budget growth at 6% and expects 1992 to be at the same rate until a substantial recovery occurs.

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According to a 1990 American Bankers Association survey, total IS budgets range from about 8% (midsized banks) to 12% or more (large banks) of total bank operating expenses, excluding interest paid out. INPUT estimates the portion of the IS budget allocated to outside services to be 6%.

E
IS Department Objectives

Based on background and findings presented throughout this report, Exhibit III-8 summarizes the objectives and plans of the banking and finance industry's information systems managers. The exhibit provides guidance for vendors planning products and services for this industry.

EXHIBIT III-8

Objectives and Plans of Information Systems Managers

- Cope with tight budgets and cost controls
- Evaluate and implement outsourcing as appropriate
- Integrate merged-bank systems
- Implement disaster recovery
- Implement RDBMSs
- Support "relationship banking"
- Explore imaging
- Research (only) most other information technologies

Budgets - Vendors selling to information systems managers in the banking and finance industry must keep in mind that although profitability is up, regulatory requirements for higher capital ratios are in force, bankers are paying higher FDIC insurance premiums, and bank IS departments are still motivated to hold costs down. Therefore, budgets continue to be tight and across-the-board cost controls are in place at most banks. Brokerages are in a similar situation, and management is still concerned with costs after waves of post-crash layoffs and other belt tightening. The budgetary bright spots are the less-regulated, nonbank financial services firms. Nonbanks generally have not suffered as much from the recession or from large amounts of poorly performing LBO or real estate loans, and they are

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not subject to the extra burdens of mandated capital ratios and increasing FDIC payments. Nonbanks are also more likely than the banks or brokerages to be in growth situations that call for increased investments in information systems and services.

Outsourcing - The bright side of the budget crunch, of course, is that outsourcing continues to be more popular than ever. Banks, in particular, have always been strong users of third-party processing services, and more and more of them are moving beyond routine yearly evaluations of outside processing to taking the action required to shut down costly in-house systems. Increasingly—far more than in the past—they are accepting proposals from a third party to take over data centers and/or other systems operations (and often staffs) in exchange for a long-term contract guaranteeing yearly savings (see Exhibit III-5). This option can prove especially attractive in merger or takeover situations, where the challenge of merging multiple information systems can be beyond the skills or resources of the systems professionals at the controlling firm. This situation has also produced significant opportunities for systems integrators, who can help the bank with complex consolidations or system/application upgrades. There is little indication, however, that nonbank institutions—brokerages or nonbank financial services firms—are particularly open to outsourcing in either form.

Disaster Recovery - As noted, disaster recovery (or contingency) planning for banks is now mandated by mid-1992, so competition—with the potential of sizable winnings for multiple contenders—can be expected for hot sites, cold sites and other such backup services. Note that the mandate also provides opportunities for third-party consulting to plan for disaster recovery and to evaluate various services and other options.

RDBMSs - RDBMs are already in place, being implemented, or being planned by most banks. A main motivator is the assistance RDBMs can provide in integrating records after a merger or takeover. Another motivator is the competitive pressure to offer relationship banking that ties together a client's multiple accounts. In terms of competitive positioning, the client becomes less likely to be lured away by another bank's offer of single statements and other integrated-account services. From the standpoint of service profitability, the bank with records organized in an RDBMS can use the data base connections to spot opportunities and expand the scope of account relationships with its best customers.

Imaging - The new imaging technology is clearly the hot item in the banking and financial services press and is being investigated at some level by most banks. The reality, however, appears to be that funding to purchase such systems—at least those at the top of the line in price and functionality—will be lacking at most banks in the near term. To the extent, however, that vendors can offer small or midsized systems providing payback for specific functions at lesser transaction rates and lower front-end investments, there may be a good short-term market opportunity.

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Research - Most leading-edge information technologies will get only research (without development) attention in the short term, because of the tight budgetary situation. As mentioned earlier, the exceptions likely will be found among the nonbank financial services firms, with the possibility of isolated exceptions for specialized functions in the fast-changing world of brokerages. To give some recent examples, American Express leads in imaging implementation and a number of brokerages have pioneered the industry's effective use of networked workstations and expert systems. Similar leading-edge work may be done by these sectors in other new technologies over the next few years, although the prime candidates now appear to be extensions of recent work in those same areas.

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IV

Information Services Market

This chapter discusses the market for information services in the banking and finance industry. Information in this chapter draws on statistics presented in Chapter I, and trends and issues discussed in Chapters II and III, to outline anticipated future directions of the market for information services.

One of the key items discussed is the trade-off between prepackaged solutions—such as processing services, applications software, and turnkey systems—and custom solutions that involve consulting or external systems development and systems integration support.

User expenditure forecasts are provided for the banking and finance industry by industry sector and by delivery mode. Assumptions driving the forecasts are presented. Note that these forecasts do not include functional general-purpose information services, such as those supporting the human resources function or generic planning and analysis. The markets for these types of information services are presented in other cross-industry MAP reports, rather than the industry-specific reports.

Section A, Overview, discusses the overall size and growth rate of the banking and finance industry's expenditures for information services.

Section B, Delivery Mode Analysis, breaks out the overall data into INPUT's seven standard delivery modes.

Section C, Industry Segment Analysis, provides a breakout of this same forecast in terms of the major market segments within the banking and finance industry. These segments are:

- Commercial banks
- Savings and loan institutions (S&Ls)
- Credit unions
- Brokerages and other financial services firms

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A
Overview

A number of business and technical driving forces will impact the banking and finance industry's use of information services during the next five years. The most important of these are summarized below.

1. Driving Forces

Capital Allocation - The most important force driving many commercial banks and S&Ls toward outside information services is the double-edged squeeze on funds from their generally low-profit positions and the regulatory requirements for higher capital ratios. Switching to either a processing service or an outside systems operator can move a banking institution's capital out of the data processing center and back into the bank's business. Also, many systems operations contracts include guaranteed annual savings over current costs.

Turnkey System Price/Performance - A different information services sector—turnkey systems—is benefitting from recent price/performance advances in minicomputer systems. The advances allow many turnkey vendors to offer midsized—and even small community—financial institutions mainframe-like power for in-house processing at much better hardware prices than in the past. Note, however, that such turnkey business often will come at the expense of the processing services on which such users relied in the past. In the most basic sense, it is this attractively priced in-house processing resource that is driving the "insourcing" trend for small and midsized banks.

RDBMSs - Many commercial banks and S&Ls are finding RDBMSs an opportunistic technology to deal with two key forces—the competitive need to implement relationship banking (which ties together records of all a customer's accounts) and the need to integrate multiple systems and records in the current wave of banking industry mergers. Vendors of the basic RDBMS software environments and of the add-on software packages that extend RDBMS functionality, especially those that work with IBM's DB2, are seeing such new opportunities.

Mergers and Acquisitions - Bank mergers and acquisitions continue to have important impacts on other information services delivery modes. Although processing services vendors may see their usage shrink somewhat as merged or acquired banks bring outside processing in-house to newly merged systems departments, several sectors clearly will benefit from the mergers. Bank system applications software vendors will see acquiring banks take a fresh look at expanded systems needs, often choosing to buy rather than build new and larger systems. Merging banks will seek professional services firms and systems integrators for advice on

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systems modification or evolution and for full-scale contracts to integrate old and new systems. Also, systems operations vendors should keep a watchful eye on mergers to identify ripe opportunities to sell the advantages of outsourcing the expanded systems department functions.

Regulatory Compliance - Commercial banks and S&Ls are being driven harder and harder to maintain their systems' compliance with fast-changing banking regulations and reporting requirements. Packaged applications software vendors, processing services vendors, and systems operators can all point out that they offer a central, economical approach to keeping the institution up to date—and in legal compliance—with such changes, so that banks can concentrate on the banking business.

Competition - Nonbank financial services firms will continue to be in relatively strong competitive positions (versus the traditional banking industry) in the near future, unless now-unforeseen new bank-like regulations are imposed. Many nonbanks are already strong users of network and processing services for credit card authorization and transaction processing. Nonbanks will prove to be good customers for:

- Banking applications software adapted to specific nonbank functions
- Professional services to help nonbanks modify software or build custom systems to meet their unique needs
- Integration of new technologies (perhaps even imaging, which nonbanks can better afford than banks can, as demonstrated by American Express) into their systems
- Operating systems in a cost-efficient fashion to keep data processing costs stable even in the face of growing business and systems requirements

2. Inhibiting Forces

In contrast, a number of forces, discussed below, are inhibiting banking and finance firms' use of information services.

Overcapacity - The industry's overall condition of overcapacity has been most obvious to date in the shrinkage of the S&L segment. It is also obvious that the current trend toward commercial bank consolidations will continue for as long as regulatory authorities will allow. Although specific opportunities will emerge from this downsizing of the industry, the absolute number of sales prospects for information services vendors will drop.

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Uncertainty - Toughest to deal with will be the uncertainty factor. At least until the federal legislation currently under consideration is either approved or rejected, the future structure of the industry will be in doubt. The implications for the shape of the banking business in the 1990s are profound, and further changes are likely to precede and follow the 1992 presidential and congressional elections. In that environment, caution by bankers can be expected to limit changes in how they manage internal information systems and contract for outside information services. Vendors, in turn, need to be flexible in considering various scenarios and business planning frameworks.

Brokerage Industry - Brokerages are still the industry wild card. Although the recent upswing in the market and the continued high levels of volume and activity have eased most of the post-1987-crash doldrums, many view the future shape of the brokerage business as questionable. Although another long-term expansion and bull market will come sooner or later, it is unlikely to strongly revive employment at—and systems or services investment by—brokerages. Brokerage management will remain cautious for some time. However, brokerages will continue to pioneer the use of technologies like expert systems for specific functions such as currency trading.

Nonbanks - Similarly, nonbank financial services firms—some affiliated with major industrial firms and some diversified only in financial services—represent another uncertainty for information services firms. Historically, nonbanks have strongly favored in-house solutions, including building their own software rather than buying packages. As noted earlier, generally nonbanks have the advantage over commercial banks and S&Ls of having money to invest in information technologies. Some, notably American Express, have been real pioneers. There have been, however, very few cases where outside information services vendors have successfully penetrated this market and maintained profitable, ongoing relationships.

Based on these driving and inhibiting forces, and other factors detailed below, INPUT projects the 1992-1997 information services market for the banking and finance industry as shown in Exhibit IV-1.

Year-by-year detail is shown in the forecast data base (Appendix B). In addition to the driving and inhibiting forces just outlined and the delivery mode-specific trends outlined in the next section, a number of industry segment-based trends are at work behind this forecast. For example, some commercial banks should experience short-term growth in processing services and systems operations, for the reasons detailed earlier. The S&Ls, however, in general can be expected to be sufficiently preoccupied with their continuing troubles that changes in their use of information services will be more the exception than the rule. The exception will be where pure cost-cutting is the motivator, one result of which could be

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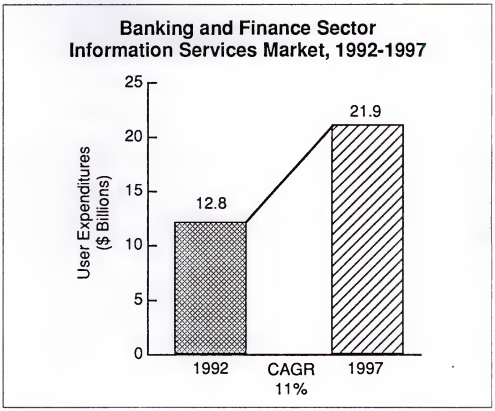
increased movement toward processing services and systems operations. Credit unions are already strong users of processing services, and little should change there. The forecast for nonbank financial services firms' use of outside information services is modest for the reasons noted earlier.

EXHIBIT IV-1



In terms of year-to-year growth rates, there is a general assumption that today's uncertainty regarding the banking industry will ease over the next several years. The economy will exit the recession and enter a period of recovery followed by stability, regulatory uncertainties will settle, consolidation and new ownership patterns will take place, and the re-establishment of stable banking industry operating conditions will lead to a period of renewed growth in the new banking business, whatever shape it takes. Despite political hopes, INPUT does not expect to see a significant and sustained economic turnaround in 1992. This forecast assumes that the pieces for recovery are in place and that the first sign of that recovery will appear in 1992. 1993 will be a year of strong economic activity, driven by industry's reaction to a prolonged period of investment and growth restrictions, and 1994 through 1997 will see a return to more stable and consistent growth patterns. Vendors will see little change in user expenditures in 1992, a spike of growth occurring as the recovery becomes apparent, and then a gradual return to normal revenue growth. Everything is affected by the economic climate. When it improves, the recession is clearly over, and a period of recovery and growth can start. There will then be a gradual return to the traditional growth patterns for information services offerings.

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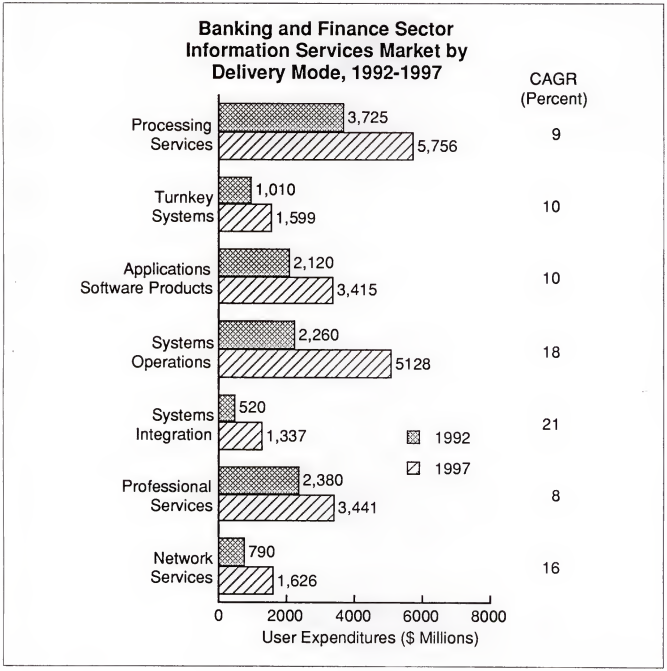
B

Delivery Mode Analysis

As shown in Exhibit IV-2, there are significant differences projected in the five-year growth rates for the information services delivery modes to the banking and finance industry.

EXHIBIT IV-2



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1. Processing Services

The banking and finance industry's use of processing services has been strong relative to that of other industry sectors. Use has always been heaviest by smaller and midsized commercial banks, S&Ls, and credit unions not willing to invest in on-site hardware to provide competitive system capabilities.

One change to these conditions during this period will be that some commercial banks and S&Ls (although generally not the smallest) will merge into larger and stronger local and super-regional banks, which generally can be expected to bring processing services in-house for consolidated economies of scale. This move in-house will be particularly true for the S&L segment, which will continue to shrink significantly in numbers through insolvency-caused closures and consolidations.

The more important trend, however, will be the increased use of processing services by commercial banks and S&Ls of all sizes, which will shift to processing services to redeploy their capital away from in-house systems and toward meeting higher capital ratio requirements. However, there will be a countertrend whereby some midsized and small commercial banks and S&Ls will find turnkey, minicomputer-based systems to be an increasingly cost-effective alternative to outside processing services' usage-based charges. Because this countertrend will be especially valuable when the bank or S&L is growing, however—and not when capital is short—it will be the lesser trend in the near term. As the economy returns to a period of sustained growth, it will become a significant factor.

There will be a constant increase in the use of credit cards during this period, and a corresponding increase in transaction volumes for third-party card-processing services, which will continue to enjoy highly competitive economies of scale.

Brokerages and nonbank financial services firms typically have not been heavy users of processing services, and no change is expected in this pattern.

Exhibit IV-3 shows the 9% CAGR expected in processing services, based on these trends.

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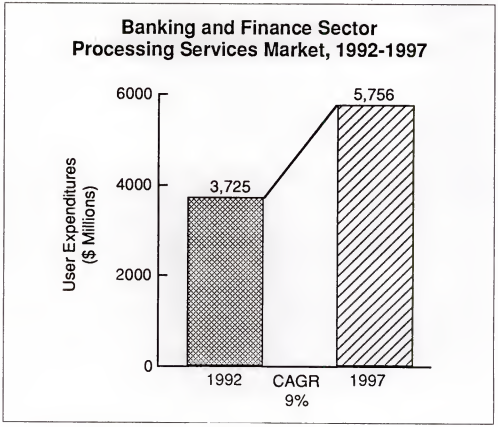
EXHIBIT IV-3



2. Network Services

Banking and finance industry firms generally are significant users of network services, especially for value-added data communication services and to a lesser extent for electronically accessed information services. The main use of network services is by bank and nonbank credit card issuers. Issuers handle purchase authorization, generally through value-added access to credit data bases through packet network services such as BT Tymnet and U.S. Sprint's Telenet.

Banking institutions and nonbank financial institutions are all heavy users of network-based credit reporting services, especially from giants such as TRW and Equifax.

Brokerages make quite different use of on-line information sources, ranging from their use of market quotation or information services like Quotron and Reuters for regular or occasional access to multiple specialized information feeds to meet specific trading needs.

Exhibit IV-4 shows the growth expected in network services, based primarily on continuing growth in the use of credit cards. Additional growth from use by brokerages assumes a continuation or increase in current market volumes.

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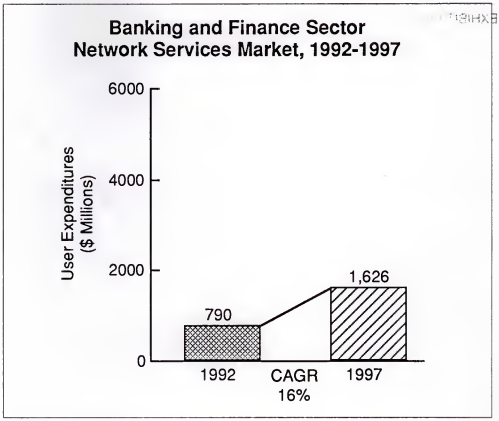
EXHIBIT IV-4



3. Applications Software Products

The banking and finance industry has always made substantial use of packaged software products, especially among the high proportion of small and midsized institutions. Generally, only the largest firms have developed the bulk of their own software systems. Many standard packages are offered, although these often require modification to meet a particular bank's needs. Modification can occur in two ways, with no particular pattern except size of institution. Smaller firms generally contract to the vendor or a third-party consultant (sometimes a small local contractor), whereas larger firms use their in-house information systems staff.

To date, PC-based banking software products (except for spreadsheet-type utilities) have not been particularly relevant in this market sector. There are few PC-based software systems robust enough to meet the high-volume transaction needs of most central banking functions. In parallel, few of the key volume-based banking peripherals are available for PC attachment. Mainframes and minicomputers remain the rule, although this rule could change with PC advances in power. (A related trend at the minicomputer level is covered under Section 6, Turnkey Systems.)

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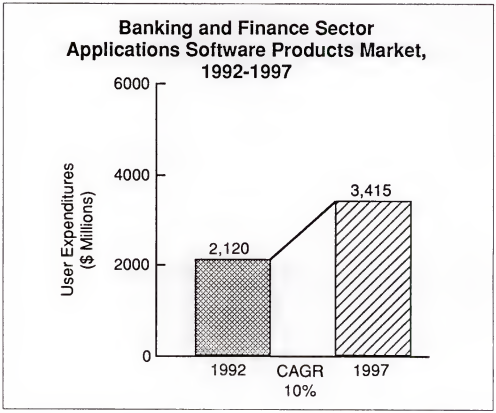
Exhibit IV-5 shows the expected growth in software products. In the short term, bankers increasingly will try to make do with existing systems except where competitive pressures—such as for RDBMS-based support of relationship banking—require new software investments. This growth rate is expected to rise somewhat, based on the return of stability, growth, and profits to the banking industry in general. Later in the period, advances in PC power—and the PC-based high-transaction-rate peripherals required—will tend to power a new generation of PC-based software applications.

EXHIBIT IV-5



4. Professional Services

The use of professional services by the banking and finance industry is strongest, historically, in the area of contract programmers and other consultants who can satisfy specific programming and systems needs on a relatively short-term, ad-hoc basis. There has also been secondary use of consultants for services such as overall systems evaluation, overviews of technologies and new technical options, and recommendations on directions for re-engineering large systems (where such large systems are typical—in the largest banks, and especially in nonbank financial institutions and large brokerages).

Exhibit IV-6 shows the growth expected in professional services.

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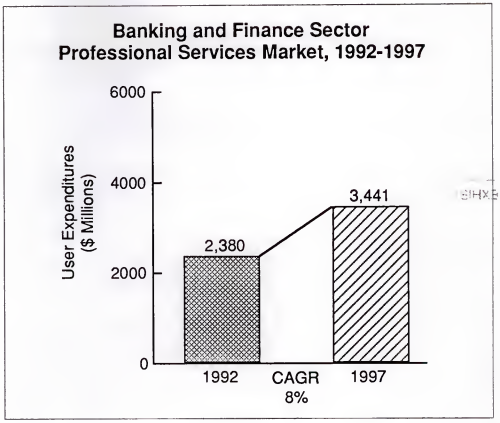
EXHIBIT IV-6



The trend in the use of professional services reflects the short-term emphasis on cost control. In this atmosphere, the first cuts generally are made in expendable contract programming and consulting services, as opposed to in-house staff. One exception, ironically, will be cost-control consulting. Such studies, of course, should be required to promise savings in excess of contract costs.

Further, despite the continuing pace of change in information technologies, cash-strapped banks generally will not pay for noncritical technology consulting in the short term. The larger nonbank financial services firms—of which there are relatively few—will likely prove the exception to this trend.

A countertrend may occur toward the end of the forecast period. As the pace of commercial bank consolidation picks up, wide-ranging opportunities should open up for professional services firms to consult with the acquiring firms on systems expansion and/or consolidation.

5. Systems Integration

The market for systems integration is closely related to that of professional services. The key distinction between professional services consulting and systems integration is who bears the ultimate responsibility for planning and managing a systems installation project. Consulting firms typically provide analytical or technical support as professional services to their

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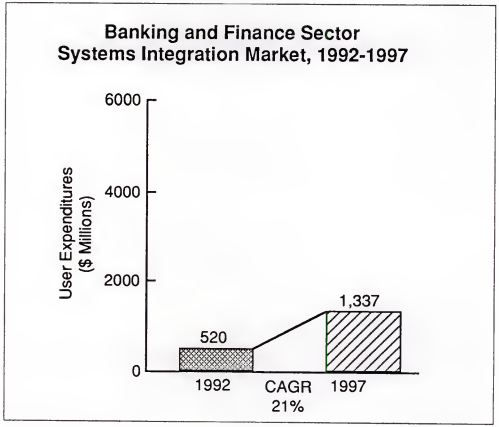
clients, while seldom bearing responsibility for the result of an implementation project. Systems integrators, in contrast, act as the general contractor on a systems project, assume project management responsibility, and generally bear some financial risk for the success of the project.

To the extent that banks and financial services firms are undertaking large new-systems projects, the complexity of today's information systems and services technologies and the rapid pace of technical change make it increasingly difficult to manage such projects, especially projects requiring a combination of in-house and outside resources.

Exhibit IV-7 shows the growth expected in systems integration. These numbers reflect the fact that, in the short term (1-2 years), relatively few commercial banks, S&Ls, or even brokerages, under current financial conditions, are undertaking complex new projects requiring systems integration services. Over the longer term (2-5 years), demand for the service will grow, as the pace of bank mergers, consolidations and re-engineering of the IS environment accelerates. The services of systems integration firms will be increasingly important to guide newly merged commercial banks through the complexities of systems consolidation. In part, the larger size of the merged organization—especially when there have been multiple, successive takeovers by one institution—eventually should drive many to cost justify larger in-house systems (with or without new technologies such as imaging) that system integrators can help set up.

EXHIBIT IV-7



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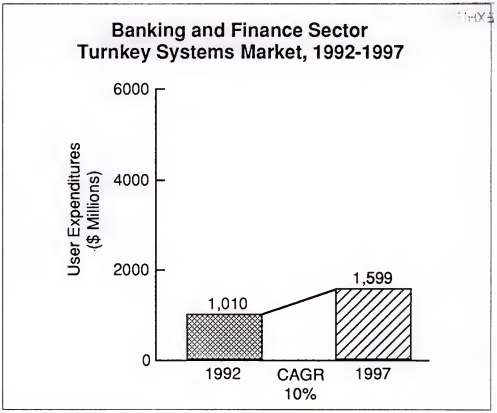
Strong and aggressive nonbank financial services firms can be expected to make relatively greater systems investments, and thus increasingly will tend to transfer such risks and responsibilities to systems integration firms. As aggressive nonbanks are relatively few, though, this transfer makes relatively little difference industrywide.

6. Turnkey Systems

By bundling the required hardware and software into a single package, turnkey systems provide an easy-to-implement solution for many midsized and community commercial banks and S&Ls. This solution is at the price, of course, of generally providing less flexibility for users, thus placing them more at the mercy of the turnkey vendor. Turnkey systems, however, generally provide the user with more flexibility than some processing service vendors' "one-service-fits-all" approach.

Exhibit IV-8 shows the growth expected in turnkey systems, which is driven primarily by a new generation of minicomputer-based systems for banks and S&Ls. These systems increasingly offer cost-effective alternatives to outside processing services, especially for growing institutions wishing to avoid the use-sensitive transaction costs inherent in a processing service. Perhaps more important, the newly cost-effective turnkey systems significantly increase the level of control available to user organizations.

EXHIBIT IV-8



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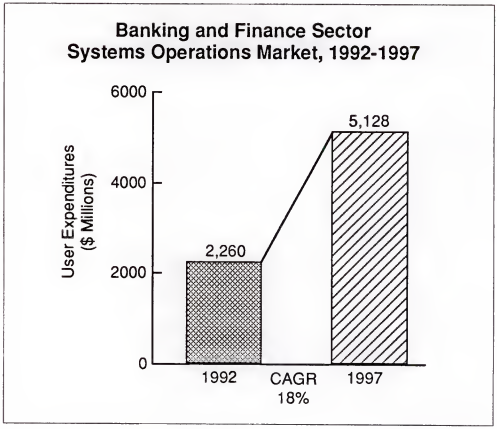
7. Systems Operations

As discussed earlier, systems operations vendors (along with vendors of processing services) were the big winners in the banking industry's recent efforts to cope with low profitability and regulatory requirements for higher capital ratios. A systems operator often offers to purchase a capital-consuming in-house data processing operation and to guarantee the bank or S&L yearly savings over the course of a multiyear contract. Over the forecast period, this combination will continue to outweigh the institution's natural hesitation to give up corporate control over a key business resource. Note, however, that credit unions (which have few in-house systems) and nonbank financial services firms (which have few regulatory requirements and generally higher profitability levels) are largely exempt from such dynamics.

Exhibit IV-9 shows the growth expected in systems operations, based on these trends.

EXHIBIT IV-9



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C
Industry Segment Analysis

In Chapter III, the banking and finance sector was segmented into commercial banks, savings institutions, credit unions and brokerages, and other financial services firms. Exhibit IV-10 provides INPUT's forecast for the segments of the banking and finance sector, and offers an estimate of relative market size.

EXHIBIT IV-10

Banking and Finance Sector
Industry Segment Markets, 1992-1997

Industry Segment	1992		1997		1992-1997 CAGR
	$ Millions	Total (Percent)	$ Millions	Total (Percent)	
Commercial Banks	6,530	51	12,260	56	13
Savings Institutions	2,430	19	3,720	17	9
Credit Unions	1,920	15	2,850	13	8
Brokerages & Other Fin. Svcs. Firms	1,920	15	3,070	14	10
Total	12,800	100	21,900	100	11

Several disparate factors are driving the growth rates in information services spending by each of the market segments in the banking and finance sector. The relatively high growth and increasing proportion of the overall information services expenditures by the commercial banking sector is tied to the sector's ability to leverage systems operations and systems integration offerings. These faster growing delivery modes are primarily driven by the medium and larger banking institutions.

Brokerages and other financial services firms show relatively steady but not high growth rates. Brokerages, although emerging from the relative stagnation that persisted for years after the 1987 crash, are still operating cautiously in a market that had risen significantly by 1991, but has not yet shown a clear return to bull market conditions. Business growth may or may not accelerate soon, but crash and layoff memories and continuing budget restrictions will limit increases in information services spending.

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The savings institutions and credit unions will see lower growth and a declining proportion of expenditures in the information services sector. These smaller institutions will be able to leverage the lower costs of client/server technology or stick with processing services offerings, and are not inclined to make frequent changes in applications software.

- For credit unions, INPUT assumes that no restrictive legislation to limit their low-cost popularity will be passed as part of federal banking regulatory reform. Enactment of such restrictions would, of course, shift these organizations to an even lower growth path.

- For savings and loans, successes are balancing the failures, but overall growth in information services expenditures will be modest.

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Competitive Environment

This section discusses the competitive environment for information services within the banking and finance industry. Leading vendors are identified and representative vendors are profiled.

A
Vendor Characteristics and Competitive Trends

A wide variety and large number of information services vendors serve the banking and finance industry, without any pattern of dominance or concentration of market control. Leading vendors are often banking-industry specialists, such as Systematics, yet many multi-industry vendors—such as the Electronic Data Systems subsidiary of General Motors (EDS)—also rank high. No single profile of vendor characteristics dominates.

Competition is intense for the business of an industry sector that includes many smaller and midsized institutions that make extensive use of information services.

B
Leading Vendors

Exhibit V-1 lists leading information services vendors serving the banking and finance industry.

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EXHIBIT V-1

Banking and Finance Sector
Leading Information Services Vendors

	Est'd Market Share (Percent)	Proc. Svcs.	Network Svcs.	Prof. Svcs.	Sys. Int.	Sys. Ops.	Turnkey Sys.	Appls. SW
Andersen	2			x	x			
CDC	1	x	x				x	
Dow Jones	4		x					
EDS	5	x	x	x	x	x		
First Data Res.	2	x						
First Fin. Mgmt.	5	x						
Fiserv	2	x			x			
GEIS	2	x	x	x				
IBM	3	x	x	x	x			x
Quotron	2		x					
Reuters	3		x					
SIAC	2	x		x				
Systematics	2					x		x
TRW	2		x	x	x			

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C
Vendor Profiles

A representative group of information services vendors serving the banking and finance industry is listed in Exhibit V-2. These vendors are profiled below.

EXHIBIT V-2

Vendor Profiles

- American Management Systems
- Broadway & Seymour
- First Data Resources
- Hogan Systems
- Mellon Information Systems
- NewTrend
- Price Waterhouse
- SunGard Data Systems
- Systematics

1. American Management Systems (AMS)

The $50 million that AMS derives from the banking and finance industry represents about 20% of AMS's overall revenue. Its business in this sector is concentrated mainly among the largest commercial banks and the big nonbank financial services firms. About 15% of this revenue is from the sale of software products such as those for credit processing and scoring, and for international credit and collections, including support of SWIFT and other electronic messaging systems. The other 85% is professional services revenue derived from support of the software packages, modification of the packages, or custom software development.

The new technology of imaging is integrated by AMS into the credit origination subsystem of the credit processing software package, in the form of images of supporting documents. In expert systems AMS now offers credit-scoring and -advice functions in the loan origination package and has a collections expert system coming. AMS integrates computer-based training technology in two of its software products and builds such courses on a custom basis for clients. Some cooperative processing capabilities linking PC-based system components with the mainframe are part of AMS's platform automation product. For now, AMS is postponing any commitment to OS/2, preferring an open-architecture approach.

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Competitively, AMS believes it stands alone against the big CPAs and leading banking and finance industry vendors, because only AMS offers software products and a wide range of consulting services. AMS emphasizes its expertise in system development and the management of systems resources for meeting tough schedules and handling complex tasks. This expertise includes key technology tools such as life cycle productivity methodology and a system design workbench. AMS emphasizes to clients that big-dollar systems investments in the past and the future can achieve correspondingly large paybacks in all bank-processing areas, but only with full integration of systems to make them flexibly accessible to a much broader range of the institution's staff and managers.

AMS sees one of its roles as helping the banking and finance industry apply technology to existing business needs, and finding new applications of technology that were not possible before because the capability did not exist.

2. Broadway & Seymour

Three-quarters of Broadway & Seymour's U.S. revenue of approximately $40 million comes from the banking industry: $15 million from large banks and $15 million from small community banks. The large-bank business is primarily custom system development and maintenance. For small banks, Broadway & Seymour provides turnkey hardware and software systems based on IBM's AS/400 minicomputer system.

In new technologies, Broadway & Seymour supports imaging in two fashions. First, Broadway & Seymour provides low-cost PC-based image statement systems that can be cost-justified at the relatively low check volume levels typical at community banks. Second, Broadway & Seymour's turnkey systems offer the option to print little-used but high-page-count documents—such as the daily balance spool file to write-once, read-many (WORM) optical disk technology—for screen-based access (and printing as required) by the relatively few bank personnel who require such access.

In the community bank market segment, Broadway & Seymour emphasizes its strength, underscored by market position and the market sector's largest number of AS/400-based installations.

3. First Data Resources

First Data Resources—a wholly owned subsidiary of American Express Information Services Company headquartered in Omaha, Nebraska—serves over 700 clients in its processing services-based business of maintaining the data bases and handling all processing of the credit cards issued by clients in the banking and finance industry. First Data Resources' business also includes securitizing credit card receivables for sale to third parties.

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First Data Resources sees its competition as other card-processing services and in-house operations. The in-house orientation of some firms and/or their reluctance to break out the costs of credit card processing tends to inhibit the growth of the business, but processing service growth is simultaneously driven by the difficulty of keeping up with changes. The Visa and MasterCard organizations, for example, keep implementing changes that processors must keep up with, and there are also periodic government regulatory changes. In keeping with industry needs and trends, First Data Resources is evaluating how to integrate imaging technology with its service offerings in the near future.

The firm competes with a number of other service vendors, such as Total Systems, Credit Services, and EDS. First Data Resources emphasizes that it has been in the business a long time and has established a depth of resources—technology and people—that is hard to match. First Data Resources has great economies of scale, yet also emphasizes that it can be very flexible in services. Overall, the company likes to say to clients, "If it's been done in credit card processing, First Data Resources has done it."

4. Hogan Systems

Hogan Systems, in Dallas, Texas, employs approximately 400 people and has revenues of $40 to $45 million. Hogan's business is concentrated in software products for large commercial banks, plus some professional services in support of the software. For years it has offered software systems for loans, deposits, and customer information, and now it also provides products for measuring and reporting financial results and for risk analysis. IBM is the exclusive U.S. marketer of the Hogan Integrated Banking Applications software product.

Technologically, Hogan supports moving mainframe functions to distributed platforms, offers an earnings analysis system based on DB2, and is building a presence in the CASE market using a customer relationship system that Hogan has developed with CASE tools that customers can update more easily than prior product offerings.

Competitively, Hogan emphasizes that it offers the most flexible products in its class. They provide better control for the banker, ease of product modification, and rapid implementation of systems to support new bank products. This flexibility and ease of use, Hogan contends, provides significant advantage, although the system is complex. Hogan also profits from installation-oriented consulting services. Newer products position Hogan strongly in the banking sector's transition from emphasizing back-office operational automation to future implementation of new systems offering new management benefits, such as profitability measures and risk analysis.

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5. Mellon Information Services

Although it has roots in the internal processing of its Mellon Bank parent, Mellon Information Services has also offered processing services for 25 years to other institutions. Revenues now total more than $250 million. Clients are mostly below the top tier of the sector and include banks and nonbank financial services firms.

Rather than implementing new technologies, the firm emphasizes the breadth of the functionality offered, based on its in-house big-bank experience.

It competes on the banking side with EDS, IBM, Marshall & Iseley, Systematics, and FIserv, and on the nonbank side with EDS, IBM, Genex, and Litton. Mellon's traditional competitive strategy has been to emphasize its years of experience and well-established products and services. Mellon has also added a new service; it will facilitate a customer's conversion from in-house operations by first running the customer's own in-house application on the processing service's computers, and only after a transition period moving to the Mellon system. This transition smooths the conversion process and permits immediate dollar savings.

For nonbanks, Mellon emphasizes support of the latest banking system internal functionality and its speed in handling functions now done manually by clients.

6. NewTrend

In May, 1991, NewTrend was formed with the merger of The NewTrend Group and the INFOPOINT™ Banking Software Division of Computer Associates International, Inc. This new venture is owned equally by Computer Associates and NewTrend, and continues to be privately held.

In 1991, NewTrend derived an estimated $68 million in revenues from the sale of processing services, software products, turnkey systems, systems integration services, and systems operations services to U.S. credit unions, S&Ls, and commercial banks. NewTrend's Unisys-based MISER2 systems include loan origination and processing, central information file, and general ledger applications, while the merged INFOPOINT applications support an IBM-based family of integrated banking software sold primarily to commercial banks.

NewTrend is considering support for the new technologies of imaging and laptop computer communication with the mainframe. The imaging system may be offered on a processing service basis. The laptop communication system would be in support of field personnel who handle loan processing.

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Competitively, NewTrend emphasizes processing services (where it competes mainly with Systematics and EDS) and turnkey systems (versus NCR and John Henry). NewTrend points out that, since the merger, almost 1,000 banks, S&Ls, credit unions and other financial institutions use NewTrend products—whether in-house, on a systems operations basis, or through NewTrend's processing service. In fact, the company notes that a bank using NewTrend software in-house can convert to NewTrend's service bureau in a single weekend if required by business changes such as a merger or a regulatory situation. NewTrend offers a strong track record of well-planned implementations that are installed in the number of days promised. NewTrend has positioned itself as a low-cost, high-function vendor that sells on a complete-package basis, without separate add-on contracts and costs. The processing service offering was added two years ago and includes NewTrend's commitment not to place more than 10 banks on a single shared system.

7. Price Waterhouse

Price Waterhouse derives more than $20 million in banking and finance industry information services revenue from the professional services activities of custom software development and system effectiveness reviews provided to all parts of the industry. It also offers software products for securities trading.

Price Waterhouse promotes implementation of imaging technology via the selection of hardware and its implementation. Implementation can be either for high-volume systems for check processing or low-volume systems that support loan documentation. For banks that want to improve electronic funds transfer (EFT) functionality, Price Waterhouse assists with automating EFT message routing, and with setting new EFT strategies. Price Waterhouse also provides professional services support for: banking applications; package implementation; crisis management for systems; custom systems development and implementation; auditing computer systems/operations; and LANs.

Price Waterhouse's primary competitors in the professional services consulting field are First Manhattan, Arthur Andersen, Peat Marwick, Booz Allen, and McKinsey. Two or three years ago, Price Waterhouse shifted competitive emphasis away from health care and government and toward banking and finance. Price Waterhouse emphasizes an interdisciplinary approach that integrates complex solutions to meet organizational, technology, and information-flow needs. Price Waterhouse's strong reputation as a firm is reinforced by excellent references from clients.

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8. SunGard Data Systems

SunGard is a major provider of disaster recovery services to all parts of the banking and finance industry. Its primary efforts involve the processing and professional services functions of establishing hot-site backup, consulting on disaster recovery, and business resumption planning. SunGard also offers software products for business recovery functions. At the end of 1990, SunGard had 1,600 employees and total corporate revenues of more than $260 million.

In addition to traditional computing/data center resources, SunGard also provides new technologies such as limited functionality for LAN-based environments. Support may be offered in the future for imaging and EDI functions.

In the disaster recovery market, the firm competes primarily with Comdisco and IBM. SunGard emphasizes its roots in mainframe systems (now evolved to encompass minicomputers as well) and a crisis management approach that tries to accommodate all clients without requiring them to declare a disaster and thus receive services only on a first-come, first-served basis.

In addition to its disaster recovery services, SunGard also offers a broad range of investment support systems. Applications include portfolio management and accounting (INVEST ONE, WISMER SERIES 2), securities trading and accounting (BOLT I and II, TRAC, PHASE3, OMNI GS), trust accounting (OMNITRUST, AUTOTRUST/AT, MICROTRUST), shareholder accounting (INVESTAR, SINSTAR), and other investment accounting (EMBERS, OMNIPLAN, PLAN ONE, PERF-4).

9. Systematics

Systematics serves the entire banking and finance industry, primarily with systems operations services, software products and development/maintenance services. Also offered are other professional services such as training, education, and consulting and a fast-growing business in systems integration (including conversions). Turnkey systems and disaster recovery services are relatively small business areas.

Although not strictly a new technology, Systematics holds a leadership position in the use of PC graphic user interface capabilities to make it easy for all bank personnel to find needed data, with or without RDBMS technology. Systematics also supports imaging for archival storage and image statements.

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The firm is an aggressive competitor in systems operations, systems integration, and professional services, and views EDS as a major rival. Hogan is a key software products competitor, and processing services competitors are EDS and FFMC. Systematics emphasizes as its strengths its multidecade record of experience, commitment to the banking and finance marketplace, and full range of products and services. Systematics believes that it provides the only complete banking solution, with offerings for retail, branch, international, trade financing, and monetary exchange. Support of international banking applications is especially important in the emerging global financial community. Systematics' fundamental technology strategy is to maximize efficiency and payback for the client. To this end, Systematics will build or buy the necessary functions to support market demand, and does not feel limited to only in-house development efforts.

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VI

Conclusions and Recommendations

A

Industry and Information Services Market Conclusions

The banking and finance industry faces a business and social environment of uncertainty and likely change during the 1990s. This will be especially true during the 1992 election year, as the Bush administration seeks to legislate a broad range of economic and financial reforms in the hope of stimulating the economy into a sustainable recovery. Regulations governing the operations and ownership of all banking segments can be expected to change, although the exact nature of short-range and mid-term changes will be subject to the uncertain interplay of powerful election-year political forces. Many S&Ls have already closed or merged with stronger institutions, and the shrinkage of the S&L segment is far from over. Further consolidation of a commercial bank segment with significant overcapacity appears inevitable. Credit unions can expect to enjoy a relatively unchanged—if unglamorous—future of local-based, nonprofit operation. The bright star, barring unforeseen regulatory changes, will continue to be the competitively aggressive and successful nonbank financial services firms.

The trend toward outsourcing will continue, with the exception that some smaller institutions will find cost-savings opportunities in the use of turnkey platforms. Overcapacity will tend to reduce expenditures for processing services, but needs for systems integration, systems operations, and network services will cause these delivery modes to grow at higher rates than the overall market. Continued budget restraints will slightly reduce expenditures for generic professional consulting services, but many of the savings may be redirected towards systems integration and systems operations activities, as financial institutions position themselves for the expanded global markets of the 1990s.

The uncertainty overshadowing this and any other market forecast is the recession—when it will end, how rapid will be the recovery, and what specific forms the recovery will take. Like Merrill-Lynch, INPUT is "bullish" on America. INPUT believes that all the pieces necessary for a

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recovery are in place, and that positive signs will appear in mid-to-late 1992, with a full recovery blossoming in 1993, and it is upon this scenario that INPUT bases its forecast for this market. Should unforeseen political, economic or international factors cause a delay, there will be a proportionate lag in the pick-up of information services spending.

As a result of these economic and industry realities, the market outlook for information services firms selling into the banking and finance sector is one of relatively modest growth in the short term. Institutions will continue spending for information services at a modest growth rate over the relatively conservative level of the past year, and will continue this pattern until a clearly recognizable and sustainable recovery occurs and the regulatory environment stabilizes. For the most part institutions are unlikely, in this environment, to undertake significant new investments.

B
User Issues and Recommendations

1. Technological Issues

Key technological issues faced by banking and finance industry information services users are outlined below.

Mergers and Acquisitions - For an increasing number of bank information systems managers, the key technological issue today is (or tomorrow will be) how best to integrate multiple systems resulting from mergers or acquisitions. At minimum, postmerger integration involves cross-system communication issues, but usually it calls for the elimination of duplicate applications, subsystems, or entire systems/services complexes in favor of integrated and more cost-effective operational environments.

Efficiencies and Downsizing - Even though profits rose in 1991, the key industrywide dynamic of low profit margins and high capital ratio requirements means that systems budgets will continue to be squeezed. Deadlines and user demands, of course, will not decrease in proportion. Thus, instead of evaluating which major investments to make, most systems managers at S&Ls and commercial banks today are faced with constant pressure to get more-efficient performance out of existing systems. This performance can sometimes be coupled with investments in high-performing new technology in the context of systems consolidation—say, from multiple data centers to a single less-costly center. In other cases, it will be both an objective and the result of a rigorous re-engineering of the bank production function, either to gain functional or performance-oriented competitive advantage.

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Disaster Recovery - Given the regulatory mandate to plan for disaster recovery, implementing such systems is a priority for any bank that has not already faced the issue. All institutions should recognize that such resources are most effective (and generate the most peace of mind) if they are fully tested, and to this end should be certain that they take advantage of the periodic testing schedules offered by virtually all vendors of contingency processing resources.

Use of Processing Services - Any institution that is considering a switch from in-house support of users to an outside processing service must carefully plan for and manage the change. Some vendors offer a transition plan whereby the user's applications are run for a time through the processing service to identify anomalies in access routines. Cutover to the processing service's own applications and resources are postponed until all production activity is functioning smoothly.

Regulation - Regulatory changes—especially for the S&Ls—are already occurring on a regular basis. Many have significant systems impacts, despite the fact that regulatory agencies rarely factor this consideration into their timeframe requirements. Systems managers must be prepared to handle such disruptions, even in the face of tight or reduced budgets.

RDBMSs - Transition to RDBMS environments is increasingly common, if not yet universal, for commercial banks and S&Ls. Nonbank financial services firms have generally already made the transition. The key technological issue is partly a business issue—understanding the business objectives well enough to choose an RDBMS that will prove cost effective. One of the challenges is projecting the likely system-load and capacity impacts—and therefore the required hardware upgrades, if any, necessary to maintain satisfactory response and performance levels.

Executive Information Systems - One of the main drivers of an institution's transition to an RDBMS will be senior management's desire or demand for an executive information system. Back-office operations (and, more recently, platform transactions and automated tellers) have been fully computerized by most institutions, yet few such systems have generated the high-level management information that can be critical in a fast-changing competitive environment. The new RDBMSs will perform a central role in making possible such executive-level systems. Note that although the costs of information technologies have always been highly visible to banking management, executive-level systems represent a new level of visibility where success will be very important to the systems managers. Successful implementation of executive management systems, and careful attention to executive needs, can smooth the way for many future IS activities.

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Imaging - Imaging technologies are being studied at one level or another by most midsized or larger institutions, but are being implemented by relatively few because of high startup costs. An important part of the costs and complexities of implementing imaging is determining how it will impact and integrate with other systems. In general, the free-form nature of electronic images is in marked contrast to the highly formatted numeric content of most of today's banking information systems.

Workstations - Outside of brokerages, the future role of the fast-evolving workstation technology in the banking and finance sector remains uncertain. Raw costs and price/performance ratios are moving fast in the directions that users favor, yet the investment required to use this technology is still sizable. Managers must decide which applications—old or new—will justify such investments, and what systems integration issues must be faced.

CASE - Many commercial banks, S&Ls, and credit unions prefer outside processing services or packaged software to in-house software development. Many institutions with significant software development shops, however, are now evaluating whether to initiate CASE. One stumbling block in today's business environment is the general agreement that, in addition to sizable dollar investments for the required systems environment, initial CASE learning curves generally result in short-term drops in programming productivity. On cost and productivity counts, therefore, CASE investment likely will be postponed by many banking industry firms.

Keeping Pace With Technology - The fact that the banking and finance industry has generally restricted funds for investment in systems has not (obviously) slackened the pace of technological change. Progressive systems managers need to find ways to make the key systems investments required to retain valuable staff if other industries offer better opportunities to use the latest technologies. For example, some investments of time and resources will be required to determine which technologies should be implemented on at least a trial basis. Trials can lead to selective new-technology cost justifications that will ease the burden of coping with a technological flood—and will provide rapidly implemented competitive advantages—as more-profitable times resume for the banking and finance sector.

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2. Business Issues

Key business issues that information services users face in the banking and finance industry are summarized below.

Priorities and Resource Allocation - Perhaps the toughest business issue for a banking and finance industry systems manager today is coping with backlogged, continuing, and new user needs in an environment of strict cost controls. An especially thorny issue for many is the additional task, on top of normal responsibilities and priorities, of integrating the systems of one or more merged banks. At some level, a triage mentality may be required, with clear communication to business management that certain current or proposed projects or investments simply must be delayed or cut from the plan in order to make reasonable progress on other higher priority or less costly ones.

Cost Efficiencies - Pressures will continue to be strong to increase the savings from existing systems. Although some institutions are successfully downsizing multiple data centers, far more are considering the cash and/or capital savings implications of switching to a processing service or third-party systems operator. On the other hand, users of processing services are also looking with interest at today's improved price/performance ratios for minicomputer-based turnkey systems.

As usual in times of budgetary restraint in any industry, users of professional services must evaluate whether such spending is actually discretionary, or of relatively lower value than preserving in-house staff or funding alternate investments. An exception is consulting related to cost-cutting or efficiency improvements or alternatives. Similarly, software development departments with reduced or frozen staff levels are evaluating the latest software packages to determine their cost and capabilities versus in-house development.

Recommendations for users that derive from the issues outlined in this section are presented in Exhibit VI-1.

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EXHIBIT VI-1

Banking and Finance Sector User Recommendations

- In all planning, consider the institution's competitive positioning as better times return.
- Deal with uncertainty by planning multiple scenarios, especially those keyed to financial condition and regulatory changes.
- Anticipate a continuation of budgetary restraints and evaluate trade-off opportunities within the systems budget.
- Review and strengthen justifications for high-priority systems budget items.
- If operating in-house, consider a processing service and/or outside systems operations to determine if cost-efficiency savings are feasible.
- Evaluate the cost effectiveness of available software packages versus in-house development.
- Fully understand and balance all business needs before choosing an RDBMS. Don't choose a dead-end alternative; know what your long-term needs will be and choose an RDBMS that can accommodate them.
- Carefully evaluate costs and benefits before undertaking imaging. Try a low-cost pilot and consider delaying implementation until costs drop or competitive pressures increase.
- Require demonstrated value for each professional services dollar.
- If your institution is of medium size or smaller, consider the benefits of the latest generation of minicomputer-based turnkey systems.
- If your institution has distributed resources, consider downsizing or merging multiple data centers.
- Determine the institution's likely merger opportunities, if any, and realistically assess the resulting systems impacts.
- Retain valuable staff. One way to do this is to make at least some investment in new technologies.

C Information Services Vendor Issues and Recommendations

Recommendations for information services vendors generally parallel those for users, as they derive from the same set of issues. These recommendations are presented in Exhibit VI-2.

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EXHIBIT VI-2

Banking and Finance Sector Vendor Recommendations

- Provide new and stronger cost justifications that buyers can present to their management.
- Develop sales approaches that recognize that cash and capital are especially tight now for most institutions in the banking and finance sector.
- Proactively defend budget line items with user management.
- Processing services vendors or outside systems operators should use this opportunity to press the case for preserving cash and/or capital.
- Vendors of software packages should ask those who have declined such resources in the past to reconsider, given the cost effectiveness of outside rather than internal development under current economic conditions.
- Minicomputer-based turnkey systems vendors must actively sell any new advantages in cost effectiveness.
- Professional services firms must be prepared to offer well-documented and tougher cost justifications of the value they deliver and the services they provide.
- Professional services firms or systems operators should look for opportunities to help larger institutions downsize or merge multiple data centers or other redundant resources.
- RDBMS vendors should work with the client to understand all current and future business needs and thus present the strongest case for their product.
- Imaging vendors should consider offering low-cost "get-acquainted" pilots.
- New technology vendors must emphasize the importance of a continuing investment in order to retain valuable staff members.
- Consider each existing user's likely merger opportunities and the impacts, positive and negative, on the vendor's systems or services.
- Look at interim business planning and consider creating scenarios to account for changes in regulations and user financial condition.
- Identify and promote the benefits of investing now to achieve competitive advantages as banking industry conditions improve.
- Place more emphasis on selling to financially and competitively strong nonbank financial services firms.

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A

Definitions

No industry-specific definition have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for the general definitions of industry structure and delivery modes used throughout INPUT reports.

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Forecast Data Base

Exhibit B-1 presents the detailed 1991-1997 forecasts for the banking and finance sector.

Banking and Finance Sector User Expenditure Forecast by Delivery Mode, 1991-1997

Sales	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
	12,045	8	12,305	14,724	16,458	18,440	19,951	21,859	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	4,204	4,659	5,246	5,724	6,255	9
[illegible]	3,465	7	3,725	4,284	4,889	5,499	5,974	6,256	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10
[illegible]	2,042	4	2,120	2,438	2,862	2,807	3,102	3,475	10
	836	[illegible]	922	[illegible]	1,276	1,275	1,264	1,424	9
	585	[illegible]	673	780	859	934	1,001	1,125	11
	490	4	509	585	673	659	756	866	11
[illegible]	2,065	10	2,260	2,599	3,107	3,177	4,267	5,129	18
[illegible]	420	8	520	598	747	852	1,045	1,257	21
[illegible]	2,[illegible]	4	2,360	2,727	3,222	3,097	3,265	[illegible]	8
[illegible]	725	[illegible]	790	909	1,072	1,222	1,[illegible]	1,525	6
[illegible] Sales	605	9	685	799	944	1,058	1,150	1,431	16
[illegible]	87	3	95	107	125	139	157	195	16

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B

Forecast Data Base

A

Forecast Data Base

Exhibit B-1 presents the detailed 1991-1997 forecasts for the banking and finance sector.

EXHIBIT B-1

Banking and Finance Sector
User Expenditure Forecast by Delivery Mode,
1991-1997

Delivery Modes	1991 ($M)	Growth 91-92 (%)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	CAGR 92-97 (%)
Sector Total	12,050	6	12,805	14,726	16,468	18,140	19,955	21,950	11
Processing Services	3,495	7	3,725	4,284	4,659	4,999	5,364	5,756	9
- Transaction Processing	3,495	7	3,725	4,284	4,659	4,999	5,364	5,756	9
Turnkey Systems	965	5	1,010	1,162	1,272	1,370	1,485	1,599	10
Applications Software Products	2,040	4	2,120	2,438	2,662	2,807	3,102	3,415	10
- Mainframe	898	4	933	1,073	1,170	1,175	1,294	1,424	9
- Minicomputer	653	4	678	780	853	934	1,027	1,126	11
- Workstation/PC	490	4	509	585	638	699	780	866	11
Systems Operations	2,055	10	2,260	2,599	3,167	3,726	4,381	5,128	18
Systems Integration	480	8	520	598	717	852	1,045	1,337	21
Professional Services	2,290	4	2,380	2,737	2,922	3,091	3,262	3,441	8
Network Services	725	9	790	909	1,070	1,227	1,417	1,626	16
- Electronic Info. Svcs.	638	9	695	799	644	1,088	1,250	1,431	16
- Network Applications	87	9	95	109	125	139	167	195	16

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B
Forecast Reconciliation

Exhibit B-2 represents the forecast reconciliation for the banking and finance sector.

EXHIBIT B-2

Banking and Finance
1992 MAP Data Base Reconciliation

Delivery Modes	1991 Market				1996 Market				91-96 CAGR per data 91 rpt (%)	91-96 CAGR per data 92 rpt (%)
	1991 Report (Fcst) ($M)	1992 Report (Actual) ($M)	Variance from 1991 Report ($M)	(%)	1991 Report (Fcst) ($M)	1992 Report (Fcst) ($M)	Variance from 1991 Report ($M)	(%)		
Total	12,194	12,050	-144	-1	20,199	19,955	-244	-1	11	11
Processing Services	3,440	3,495	55	2	4,988	5,364	376	1	8	9
Turnkey Systems	1,000	965	-35	-4	1,460	1,485	25	2	8	9
Applications Software	2,270	2,040	-230	-10	3,480	3,102	-378	-11	9	9
Systems Operations	2,046	2,055	9	<1	4,659	4,381	-278	-6	18	16
Systems Integration	404	480	76	19	1,022	1,045	23	2	20	17
Professional Services	2,184	2,290	106	5	2,880	3,262	382	13	6	7
Network Services	850	725	-125	-15	1,710	1,417	-293	-17	15	14

The significant differences between the 1991 and 1992 forecasts are as follows:

Overall growth of the information services market within the banking and finance industry was slightly less than expected. This results in a reduction in the market size of $144 million at the end of 1991, as compared to the prior year's projection. User expenditures were just over $12 billion, as compared to the forecast $12.2 billion. These changes reflect the continuing effects of the recession, which many had hoped would end in 1991.

Applications software and network services expenditures were projected to grow in 1991 but as a result of the continued effects of the economic slowdown, actually declined from 1990. Reflecting an ongoing concern with cost efficiency and the need to integrate resources resulting from mergers and aquisitions, actual spending levels for systems integration grew in 1991.

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Expenditures for turnkey systems and professional services were greater than forecast by $35 million and $106 million, respectively. Both represent positive variances of 4%-5% from last year's forecast. The professional services variance reflects the continued dependence by the financial services market on critical consulting and training skills offered by professional services vendors. Use of turnkey systems declined despite increased insourcing by small and midsized banks using cost-effective turnkey platforms.

The 1991-1996 CAGR percentages have remained fairly constant, with some variance in the systems integration rate resulting from delays in the economic recovery. By 1997, however, continued aggressive growth in SI expenditure will move the 1992-1997 CAGR to 21%. Essentially, the 1990 and 1991 numbers represent industry reactions to economic uncertainty, and the 1992 through 1997 forecasts are based upon INPUT's assumptions as to when, and at what pace, a sustainable recovery will occur.

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